HUC 10300102 – Lower Missouri-Moreau
Water body ID: 710
Pollutant(s): Low dissolved oxygen and organic sediment

Revised
Total Maximum Daily Load
for
Stinson Creek
Callaway County, MO

Impairments: Dissolved Oxygen and Organic Sediment

Submitted: January 30, 2020
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Approved: December 17, 2021

Prepared by: Water Protection Program, Watershed Protection Section

WATER BODY SUMMARY
Total Maximum Daily Load for Stinson Creek
Pollutants: Low dissolved oxygen and organic sediment

Name: Stinson Creek

Location: Callaway County near Fulton

8-digit Hydrologic Unit Code (HUC):[1]
10300102 – Lower Missouri-Moreau

12-digit HUC Subwatersheds:
103001021508 – Stinson Creek

Water Body Identification Number (WBID) and Hydrologic Class:[2]
WBID 710 – Class C

Designated Uses:[3]
Irrigation
Livestock and wildlife protection
Human health protection
Warm water habitat (aquatic life)
Whole body contact recreation category B
Secondary contact recreation

Impaired Use:
Warm water habitat (aquatic life)

Pollutants and Sources Identified on the 303(d) List:
Low dissolved oxygen – Unknown source
Organic sediment – Fulton Wastewater Treatment Facility

Length and Location of WBID 710:
11.9 miles from mouth to Section 16, Township 47N, Range 9W

Length and Location of Impairment within WBID 710:[4]
4.4 miles from Section 27, Township 47N, Range 9W to Section 16, Township 47N, Range 9W

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[1] Watersheds are delineated by the U.S. Geological Survey using a nationwide system based on surface hydrologic features. This system divides the country into 2,270 8-digit hydrologic units (USGS 2019). A hydrologic unit is a drainage area delineated to nest in a multilevel, hierarchical drainage system. A hydrologic unit code is the numerical identifier of a specific hydrologic unit consisting of a 2-digit sequence for each specific level within the delineation hierarchy (FGDC 2003).

[2] For hydrologic classes see 10 CSR 20-7.031(1)(F). Class C streams may cease flow in dry periods, but maintain permanent pools that support aquatic life.

[3] For designated uses see 10 CSR 20-7.031(1)(C) and 10 CSR 20-7.031 Table H. Presumed uses are assigned per 10 CSR 20-7.031(2)(A) and (B) and are reflected in the Missouri Use Designation Dataset described at 10 CSR 20-7.031(2)(E).

[4] The original impairment addressed in the 2010 TMDL was 0.1 miles. For this revised TMDL, based on available water quality assessment data, the Department has identified the length of the impairment as extending 4.4 miles. Although available data downstream of this 4.4-mile portion of Stinson Creek shows compliance with Missouri's Water Quality Standards, this TMDL is written to be protective of the entire 11.9 mile length of WBID 710.

Table of Contents

Figures

Tables

1. Introduction

The Missouri Department of Natural Resources in accordance with Section 303(d) of the federal Clean Water Act is establishing this total maximum daily load (TMDL) to address the low dissolved oxygen and organic sediment impairments in Stinson Creek near Fulton in Callaway County. This Revised TMDL supersedes the TMDL approved by the U.S. Environmental Protection Agency (EPA) on May 26, 2010, that was established to meet the milestones of the 2001 Consent Decree, *American Canoe Association, et al. v. EPA*, No. 98-1195-CV-W in consolidation with No. 98-4282-CV-W, February 27, 2001. Stinson Creek was first listed on the 1994 Missouri 303(d) List of impaired waters for biochemical oxygen demand from an "unknown" source, and subsequently placed on the 2002 Missouri 303(d) List for volatile suspended solids from the Fulton Wastewater Treatment Facility.[5] On the combined 2004/2006 303(d) List these pollutants were changed from biochemical oxygen demand to low dissolved oxygen and from volatile suspended solids to organic sediment. Stinson Creek remained listed as impaired by these pollutants on the 2008 303(d) List.

Section 303(d) of the federal Clean Water Act and Title 40 of the Code of Federal Regulations (CFR) Part 130 require states to develop TMDLs for waters not meeting applicable water quality standards. Missouri's Water Quality Standards at Title 10 of the Code of State Regulations (CSR) Division 20 Chapter 7.031 consist of three major components: designated uses, water quality criteria to protect those uses, and an antidegradation policy. The purpose of a TMDL is to determine the loading capacity of a specific pollutant that a water body can assimilate without exceeding the applicable Water Quality Standards for that water body. The TMDL process quantitatively assesses impairment factors so that water quality-based controls can be established to reduce pollutant loading and to restore and protect the quality of Missouri's water resources. Based on the relationship between pollutant sources and in-stream water quality conditions, a TMDL is the sum of a wasteload allocation and a load allocation (40 CFR 130.2) with a margin of safety (federal Clean Water Act section 303(d)(1)(C)). The wasteload allocation is the fraction of the loading capacity apportioned to existing or future point sources. The load allocation is the fraction of the loading capacity apportioned to existing or future nonpoint sources and natural background. The margin of safety is a portion of the TMDL that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality (40 CFR 130.7), any uncertainty associated with the model assumptions, and data inadequacies.

2. Rationale for Revision

A review of the QUAL2K model used to develop the 2010 TMDL revealed that the 2008 water quality dataset used to calibrate the 2010 QUAL2K model included only dissolved oxygen data measured during mid to late afternoon periods when dissolved oxygen concentrations in the stream are elevated due to photosynthetic processes. Such measurements are not representative of the critical conditions in Stinson Creek when low dissolved oxygen is likely to occur. Instead, critically low dissolved oxygen concentrations occur in the early morning when biological respiration processes have consumed the oxygen generated by daytime photosynthesis. Due to these incorrect

[5] The Department maintains current and past 303(d) lists and corresponding assessment worksheets online at dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/impaired-waters.

model inputs used during the development of the 2010 TMDL, a re-evaluation of the calculated loading capacity and associated allocations necessary to attain water quality standards is warranted.

In addition to inappropriate modeling inputs, the Fulton Wastewater Treatment Facility has implemented various improvements since the development of the 2010 TMDL. Such improvements include eliminating untreated bypasses, upgrading mechanical treatment, ammonia removal, additional clarification, and an excess holding basin that allows the facility to handle peak flows of up to 7.63 million gallons per day (MGD). These improvements, completed in 2017, provide additional reason for re-evaluating the water quality targets for attainment of water quality standards in Stinson Creek.

The 2010 Stinson Creek TMDL established total nitrogen (TN) and total phosphorus (TP) wasteload and load allocations based on EPA Level III Ecoregion 40 criteria (USEPA 2000). However, the Ecoregion 40 nutrient criteria targets were developed based on streams in pristine or near-pristine environments, and may not be representative of more localized reference conditions. The targets are not tied to specific biological conditions or Missouri's minimum dissolved oxygen criterion. Additionally, these federally recommended nutrient criteria use a statistic-based distributional approach that has little or no linkage to biological "cause and effect" responses or ecologically significant thresholds, and merely represents an administrative water quality protection policy that guides EPA's clean water programs. For these reasons, these targets may not be appropriate metrics for use as wasteload allocations for point source discharge from wastewater treatment facilities. The Department has revised the Stinson Creek TMDL based on critical low flow dissolved oxygen data and has established pollutant targets that are proportionate to the existing land uses and geomorphic characteristics of Stinson Creek and its contributing watershed. The pollutant targets in the revised TMDL have been established such that the 5.0 milligrams per liter (mg/L) minimum criterion for dissolved oxygen will be achieved, and organic sediment will be reduced to ensure conditions are consistent with Missouri's general narrative water quality criteria. Such targets will result in restoration of the protection of warm water habitat (aquatic life) designated use in Stinson Creek and will be protective of downstream uses.

The targets and information provided in this revised TMDL replace those found in the 2010 TMDL. The ultimate endpoint for this revised TMDL will be to meet Missouri Water Quality Standards through attainment of the minimum dissolved oxygen criterion for the protection of aquatic life in warm water habitats of 5.0 mg/L and general criteria associated with excessive sedimentation. Compliance with these criteria will be determined in accordance with Department assessment procedures for federal Clean Water Act sections 305(b) and 303(d) reporting. All pollutant reductions necessary to achieve the TMDL targets calculated in this revised TMDL shall be implemented until such a point that water quality standards are attained. If all point source and nonpoint source pollutant targets are achieved, but water quality standards are not attained, then additional monitoring will be scheduled and the TMDL may be further revised.

3. Water Body and Watershed Descriptions

Stinson Creek is located in central Missouri within the Lower Missouri-Moreau subbasin, which is catalogued by the U.S. Geological Survey (USGS) as the 8-digit hydrologic unit code (HUC) 10300102. Stinson Creek is a 25 mile long stream located in the Stinson Creek 12-digit HUC

(103001021508) subwatershed, which drains approximately 46.8 square miles.[6] The stream originates approximately 0.7 mi south of Interstate 70, approximately 11 miles west of Kingdom City, flows through the City of Fulton, and eventually into Auxvasse Creek. An approximately 11.9 mile stretch of Stinson Creek, from the confluence with Auxvasse Creek to approximately 0.25 miles southeast of the intersection of state highways O and C, is identified as water body ID (WBID) 710 in Missouri's Water Quality Standards. Based on available water quality data, 4.4 miles of WBID 710 from 0.1 mile above the confluence with Youngs Creek to 0.74 mile above the Fulton Wastewater Treatment Facility has been identified as impaired due to low dissolved oxygen. The area draining to this 4.4 mile impaired segment is approximately 26 square miles. In addition to receiving effluent from the Fulton Wastewater Treatment Facility, the 4.4 mile impaired segment of Stinson Creek receives water from the Fulton municipal separate storm sewer system (MS4) which collects water from the 12.39 square mile area of the City of Fulton. Contributions from the Fulton MS4 are conveyed primarily through Smith Branch, a tributary to Stinson Creek. Smith Branch enters Stinson Creek approximately 0.18 mile downstream of the Fulton Wastewater Treatment Facility. The Smith Branch subwatershed collects water from a 4.7 square mile area of which 3.2 square miles, or 68 percent, lies within the City of Fulton. The entire Stinson Creek 12-digit watershed is presented in Figure 1.

Prior to 2014, the upper 13-mile portion of Stinson Creek did not have designated beneficial uses. Designation of beneficial uses for the upper stream segment occurred through water quality standard revisions published on January 29, 2014, and recorded in the Missouri Use Designation Dataset (MUDD). The MUDD is defined in 10 CSR 20-7.031(1)(Q) and documents the names and locations of the state's water bodies that have been assigned designated uses. In addition to those waters identified in Tables G and H of 10 CSR 20-7.031, the MUDD identifies water bodies included within the 100,000-scale extent of the National Hydrography Dataset (NHD) that did not have designated uses prior to January 29, 2014. These additional streams have now collectively been assigned WBID 3960. Although available water quality data indicate some violations of Missouri's minimum dissolved oxygen criteria in these upper reaches of Stinson Creek, these segments have not formally been assessed as impaired and are not the subject of this revised TMDL. Should these segments be identified as impaired on future 303(d) lists, then TMDL development will be prioritized and scheduled at that time.

[6] The entire Stinson Creek watershed is approximately 115.7 square miles and includes the 12-digit HUC subwatersheds of Crow Fork Creek (HUC 103001021507) and Richland Creek (HUC 103001021506). Because flows from these subwatersheds enter Stinson Creek downstream from where water quality data indicate impairment, these 12-digit HUCs are not considered in this TMDL. This approach focuses pollutant reductions and implementation activities to achieve those reductions to areas contributing to the impairment of Stinson Creek and is consistent with that used in development of the original 2010 TMDL.

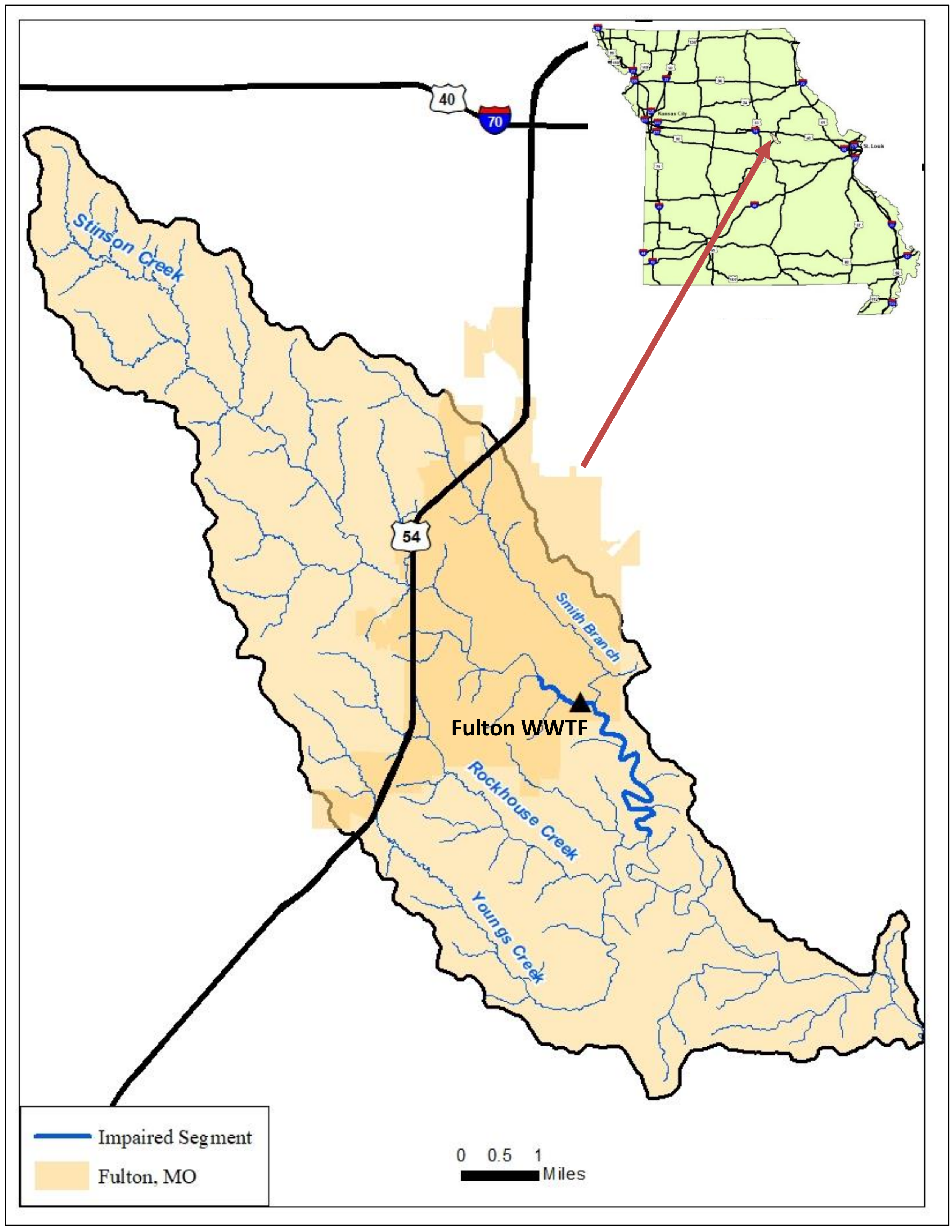

Figure 1. Stinson Creek Watershed, 12-digit HUC 103001021508

3.1 Geology, Physiography and Soils

The Stinson Creek watershed is located within the Moreau/Loutre ecological drainage unit (EDU). Ecological drainage units are groups of watersheds that have similar biota, geography, and climate characteristics (USGS 2009). The Moreau/Loutre EDU includes all of the smaller direct tributaries to the Missouri River, and extends to the confluence of the Missouri and Mississippi Rivers. The landscape where Stinson Creek is located is more prairie than Ozark in nature with deep, fine textured soils. Streams are warm and turbid with a high percentage of sand and silt substrate (MoRAP 2005).

The Stinson Creek watershed is also located in the Interior River Valleys and Hills Level IV Ecoregion. The Interior River Valleys and Hills Ecoregion is characterized by smooth to moderately dissected, forested river slopes and bluffs, some loess-covered hills, and areas with karst features. The area is a transitional zone between the till-covered plains to the north and the rocky soils of the Ozark Highlands (Chapman et al. 2002).

As presented in Table 1, the predominant soils in the contributing watershed consist of silt loam, clay loam, and silty clay loam. Although soils in the watershed are varied, they can be categorized based on similar runoff potentials into hydrologic soil groups. A hydrologic soil group indicates the rate at which water enters the soil profile under conditions of a bare, thoroughly wetted soil surface, which in turn may affect the potential amount of water entering the stream as runoff (NRCS 2009). Group A represents soils with the highest rate of infiltration and the lowest runoff potential. Group D soils have the lowest rate of infiltration and the highest potential for runoff. Group C soils have a low-moderate rate of infiltration and a moderate-high potential for runoff. Dual soil groups (e.g., B/D) account for the presence of a high water table by providing both the drained and undrained condition of the soil.[7] Table 2 provides a summary of the hydrologic soils groups in the Stinson Creek watershed and Figure 2 shows their distribution. There are no Group A soils in the Stinson Creek watershed.

[7] For the purpose of hydrologic soil group, adequately drained means that the seasonal high water table is kept at least 24 inches (60 centimeters) below the surface in a soil where it would be higher in a natural state (NRCS 2009).

Table 1. Predominant Soils in the Stinson Creek Watershed (NRCS 2017)

Soil Type	Description	Characteristics	Hydrologic Soil Group	Percentage of Watershed (%)
Keswick loam, Audrain –Shelby plain	5 to 9 percent slopes, eroded	A somewhat poorly drained soil found on hillside backslopes	D	29.0
Mexico silt loam	0 to 4 percent slopes	A poorly drained soil found on ridge summits	D	20.0
Goss-Gasconade-Rock outcrop complex	5 to 35 percent slopes	A well drained soil found on hillside shoulders and backslopes	C	12.1
Calwoods silt loam	2 to 5 percent slopes	A somewhat poorly drained soil found interfluve summits and hillside shoulders	D	8.2
Lindley clay loam	9 to 14 percent slopes, eroded	A well drained soil found on hillside backslopes	D	4.0
Lindley loam	14 to 40 percent slopes	A well drained soil found on hillside backslopes	C	3.9
Landes loam	0 to 2 percent slopes, frequently flooded	A well drained soil found on valley floodplains	B	3.0
Armstrong loam	5 to 9 percent slopes, eroded	A somewhat poorly drained soil found on hillside backslopes	D	2.4
Gorin silt loam	3 to 9 percent slopes, eroded	A somewhat poorly drained soil found ridge summits	C	1.8

Table 2. Summary of Hydrologic Soil Groups in the Stinson Creek Watershed (NRCS 2009)

Hydrologic Soil Group	Area (mi^2)	Area (%)
Not Rated (Open Water)	0.42	0.9
B	3.15	6.7
B/D	0.45	1.0
C	9.47	20.2
C/D	3.02	6.5
D	30.30	64.7
Total	46.81	100.0

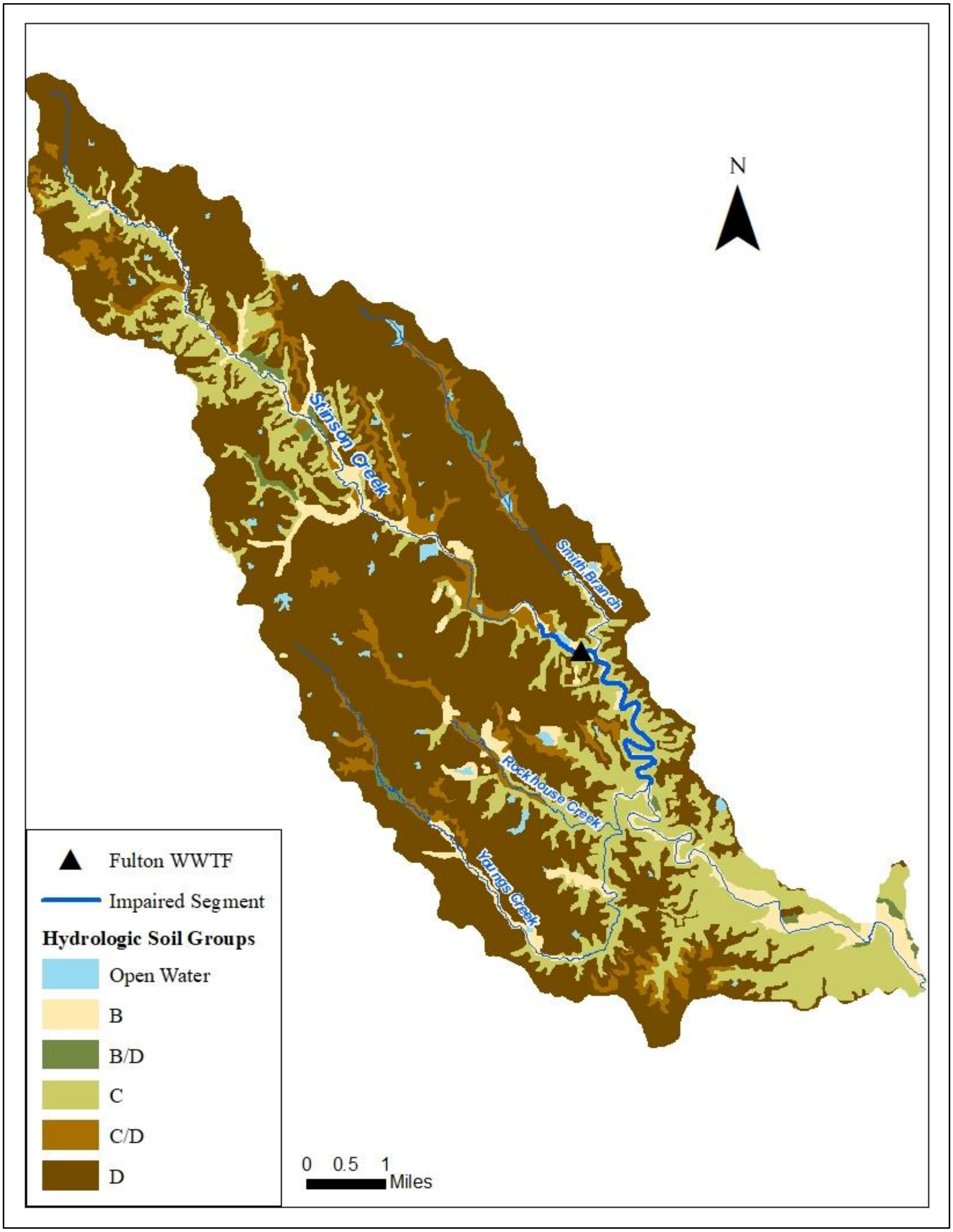

Figure 2. Hydrologic Soil Groups in the Stinson Creek Watershed, 12-digit HUC 103001021508

3.2 Climate

Climate normals are 30-year averages of climatological variables, including temperature and precipitation, produced by the National Centers for Environmental Information every 10 years (NOAA 2010). The monthly precipitation and temperature normal are calculated using daily weather data from the Columbia Regional Airport (Station No. USC00231801) and are representative of the climatic conditions in the Stinson Creek watershed. Of the various climatic factors, precipitation is especially important as it is related to stream flow and runoff events that can influence the transport of pollutants from nonpoint sources into streams. Water quality data recorded in 2002 were used to model Stinson Creek. Table 3 and Figures 3 and 4 compare 2002 temperature and precipitation data with the 30-year climate normal rainfall and temperature data observed at Columbia Regional Airport Station. The U.S. Drought Monitor (University of Nebraska 2019) determined that the Lower Missouri-Moreau HUC-8 was not in drought in 2002.

Table 3. Comparison of Climate Normals and 2002 Data at the Columbia Regional Airport Weather Station No. USC00231801 (NOAA 2010)

	Precipitation (inches)		Max. Temp. (ºF)		Min. Temp. (ºF)	
Month	**Normal**	**2002**	**Normal**	**2002**	**Normal**	**2002**
January	1.29	2.92	38.5	67	20.9	6
February	2.25	1.03	43.9	72	24.9	10
March	2.91	2.52	55.2	78	34.0	-1
April	4.49	5.39	66.1	88	44.0	24
May	4.98	10.15	74.5	83	53.5	36
June	4.47	3.21	83.0	93	62.8	51
July	4.37	3.04	87.6	98	67.0	58
August	4.36	3.97	87.0	100	65.4	56
September	3.87	1.55	78.8	93	56.4	42
October	3.31	4.91	67.1	89	45.0	31
November	3.25	1.11	53.9	72	34.9	17
December	2.44	3.06	41.1	67	23.7	7
	Total		**Average**		**Average**	
	42.62	**42.68**	**64.73**	**83**	**44.41**	**28**

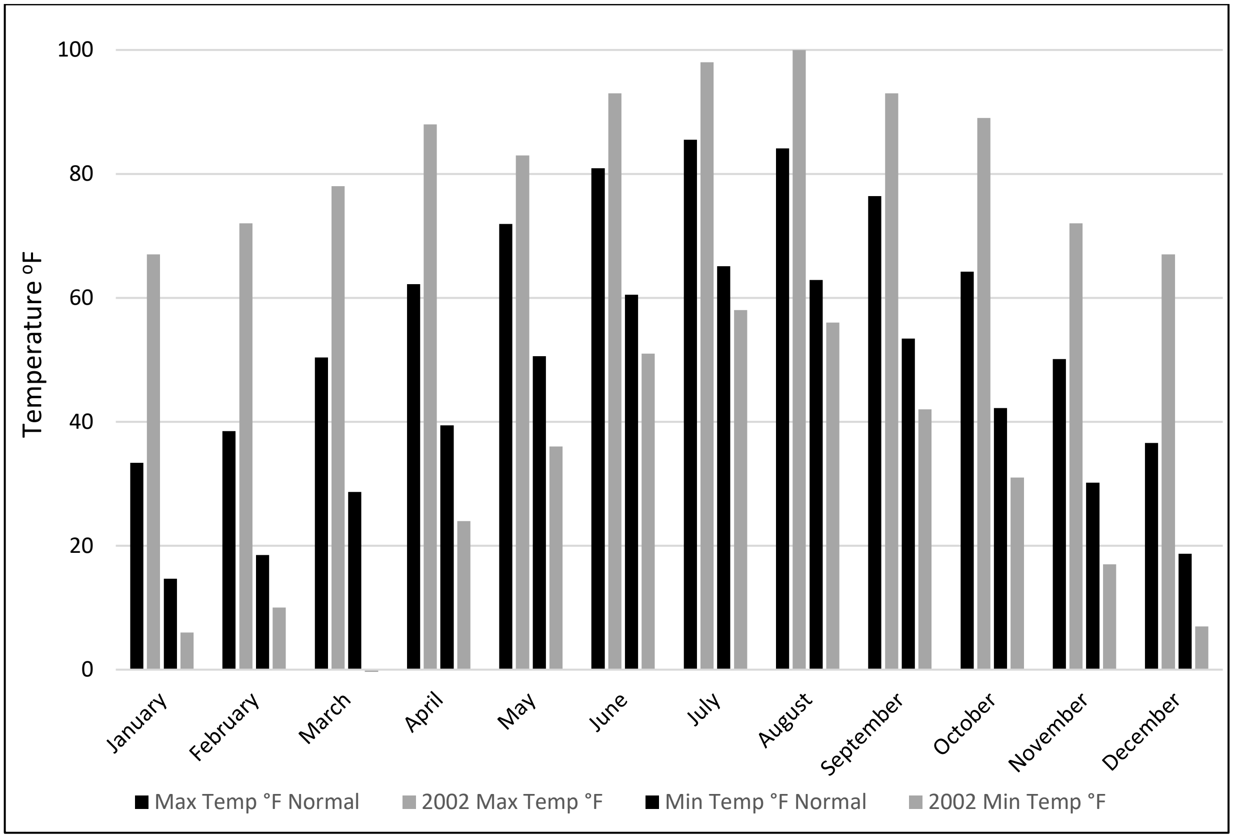

Figure 3. Comparison of Climate Normal and 2002 Average Monthly Minimum and Maximum Temperatures

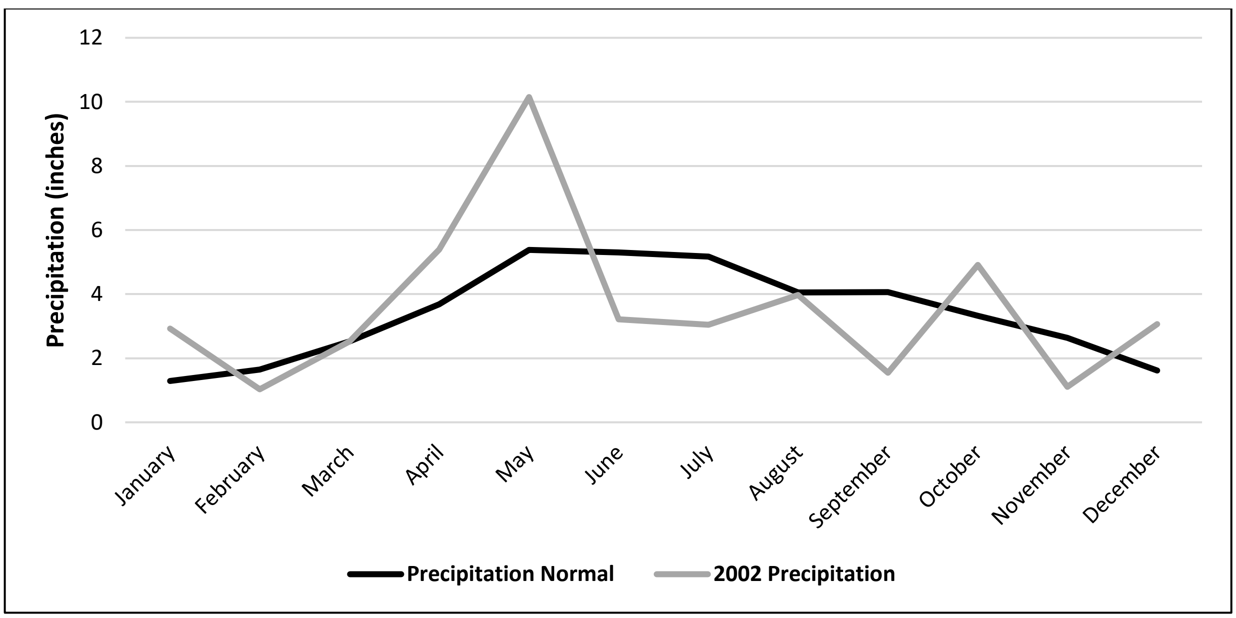

Figure 4. Comparison of Climate Normal and 2002 Average Monthly Precipitation

3.3 Population

The population estimates presented in Table 4 were derived using Geographic Information System (GIS) software and superimposing the watershed boundary over a map of census blocks (Figure 5). Wherever the centroid of a census block fell within a watershed boundary, the entire population of the census block was included in the total. If the centroid of the census block was outside the boundary, then the population of the entire block was excluded. Using a similar method, the municipal population was estimated by superimposing municipal areas over the map of census blocks.

Table 4. Population Estimates for the Stinson Creek Watershed

Municipal Population			Rural Population			Total Population		
1990	**2000**	**2010**	**1990**	**2000**	**2010**	**1990**	**2000**	**2010**
9,268	11,213	11,504	1,657	1,909	2,112	10,925	13,122	13,616

The U.S. Census Bureau estimated the population in the City of Fulton to be 11,504 in 2010. Of the 12.4 square mile municipal boundary, approximately 12.0 square miles are within the Stinson Creek watershed. Population growth between 1990 and 2010 was approximately 20 percent in the Stinson Creek watershed.

In 2013, EPA completed a separate population analysis based on 12-digit HUC subwatersheds for purposes unrelated to this TMDL. They used demographic and census block data, and a web-based tool called EJSCREEN to determine areas of Missouri having potential Environmental Justice concerns. EPA defines Environmental Justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The EPA analysis is based on the percentage of minority populations and the percentage of people below the poverty level at the U.S. Census Bureau block level. Environmental justice areas are currently based on 2010 census data and may change when 2020 census data becomes available.From this analysis, EPA determined that the Stinson Creek watershed has some potential environmental justice concerns (5-15 percent area). Environmental Justice communities may qualify for financial and strategic assistance for addressing environmental and public health issues. One example of financial assistance the Department offers that may be available to areas having environmental justice concerns is Section 319 grant funding to address nonpoint sources. The Department evaluates 319 grants on a number of criteria, but gives higher priority for selection to proposed projects in disadvantaged communities. Additional grant and financial resource information is available on EPA's environmental justice website at www.epa.gov/environmentaljustice.

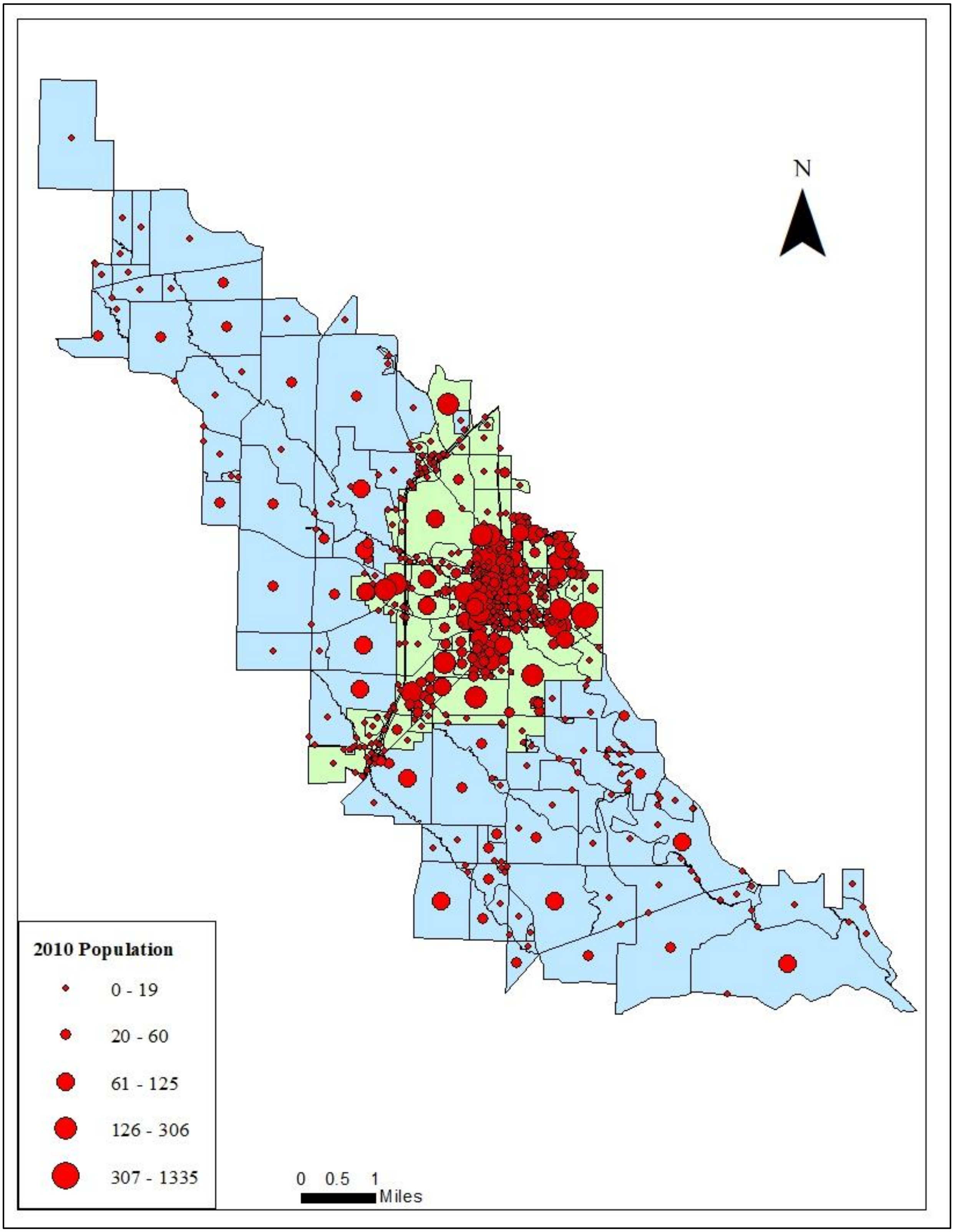

Figure 5. Population Density in the Stinson Creek Watershed, 12-digit HUC 103001021508

3.4 Land Cover

A land cover analysis was completed using the 2011 National Land Cover Database (NLCD) published by the USGS (Homer et al. 2015). Land cover area in the Stinson Creek watershed is summarized in Table 5 and presented in Figure 5. The total amount of developed area in the Stinson Creek watershed is approximately 14 percent. Impervious surfaces associated with the developed land cover types ranges from less than 20 percent to greater than 79 percent. Stream degradation associated with impervious surfaces has been shown to first occur at about 10 percent impervious and increases in severity as imperviousness increases (Arnold and Gibbons 1996; Schueler 1994). Although hay and pasture land covers 41.9 percent of the Stinson Creek watershed, much of the land area drains to Youngs and Rockhouse Creeks, which flow into Stinson Creek downstream of the impaired segment (Figure 1).

Table 5. Land Cover in the Stinson Creek Watershed (NLCD, 2011)

Land Cover	Acres	Square Mile	Percent
Barren Land	51	0.1	0.17%
Cultivated Crops	2,301	3.6	7.68%
Developed, High Intensity	256	0.4	0.86%
Developed, Low Intensity	1,584	2.5	5.29%
Developed, Medium Intensity	783	1.2	2.61%
Developed, Open Space	1,588	2.5	5.30%
Forest	10,068	15.7	33.62%
Hay and Pasture	12,554	19.6	41.92%
Open Water	188	0.3	0.63%
Shrub and Herbaceous	304	0.5	1.01%
Wetlands	272	0.4	0.91%
Total	29,949	46.8	100.0%

The Smith Branch subwatershed constitutes 10 percent of the Stinson Creek watershed. Runoff from the Smith Branch subwatershed enters the impaired segment of Stinson Creek 0.18 mile downstream of the Fulton Wastewater Treatment Facility. Developed areas cover 39.4 percent of the Smith Branch watershed. Although hay and pasture land covers 35.3 percent of the Smith Branch watershed, it should be noted that approximately 68 percent of the Smith Branch subwatershed is contained within the boundaries of the City of Fulton's municipal area where stormwater is conveyed through the City's MS4. This includes nearly half (48 percent) of the areas identified in the subwatershed as being hay and pasture and about 13 percent of areas identified as cropland. Land cover area in the Smith Branch subwatershed is summarized in Table 6.

Table 6. Land Cover in the Smith Branch Subwatershed

Land Cover	Acres	Square Mile	Percent
Barren Land	11	0.02	0.4%
Cultivated Crops	223	0.35	7.5%
Developed, High Intensity	68	0.11	2.3%
Developed, Low Intensity	433	0.68	14.5%
Developed, Medium Intensity	196	0.31	6.6%
Developed, Open Space	479	0.75	16.0%
Forest	424	0.66	14.2%
Hay and Pasture	1,056	1.65	35.3%
Open Water	55	0.09	1.9%
Shrub and Herbaceous	18	0.03	0.6%
Wetlands	28	0.04	0.9%
Total	2,991	4.67	100.0%

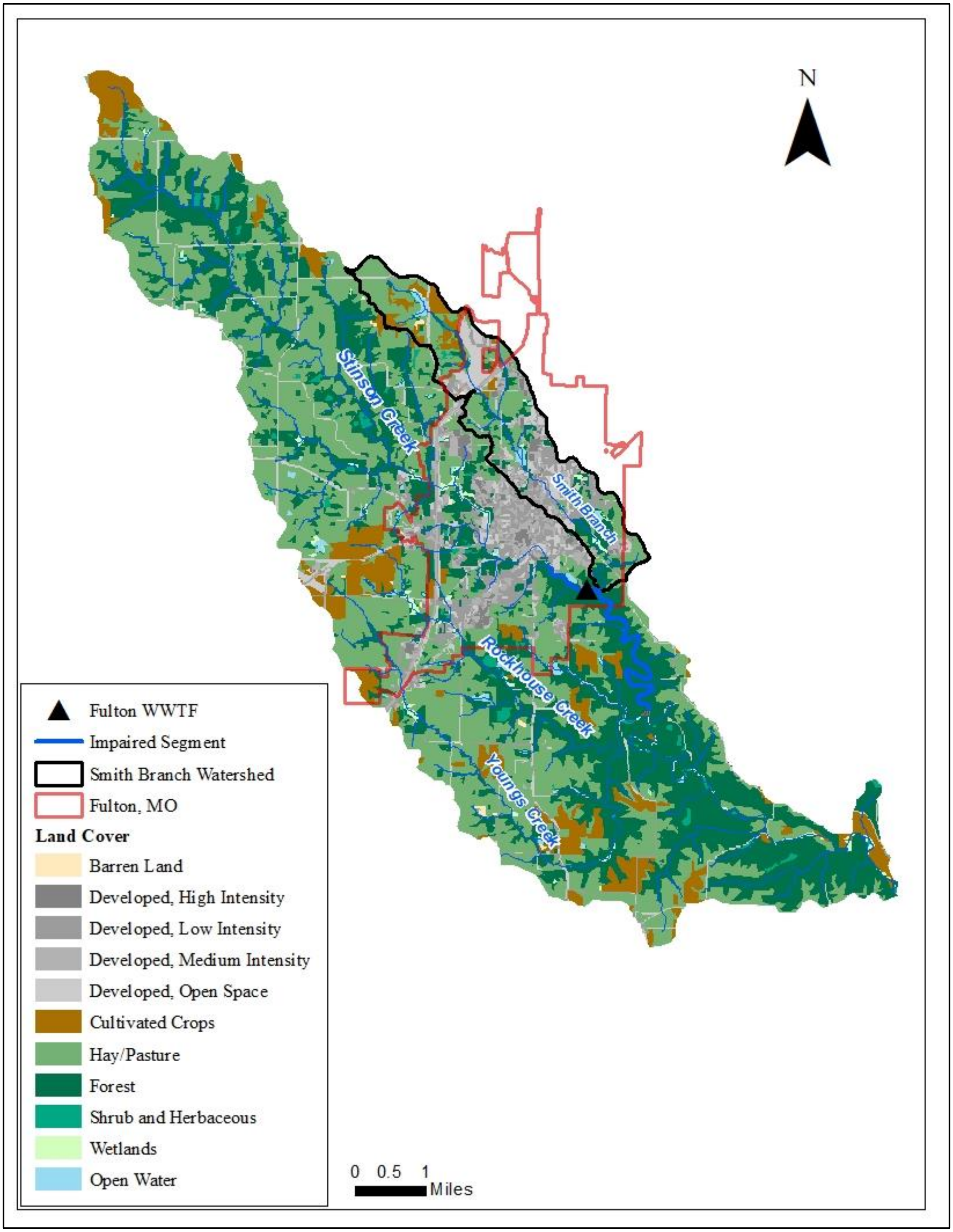

Figure 6. Land Cover in the Stinson Creek Watershed, 12-digit HUC 103001021508

4. Applicable Water Quality Standards

The purpose of developing a TMDL is to identify the maximum pollutant loading that a water body can assimilate and still attain and maintain water quality standards. Water quality standards are therefore central to the TMDL development process. Under the federal Clean Water Act, every state must adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters (U.S. Code Title 33, Chapter 26, Subchapter III). Water quality standards consist of three major components: designated uses, water quality criteria, and an antidegradation policy.

Per federal regulations at 40 CFR 131.10, the designated uses and criteria to protect those uses assigned to a water body shall provide for the attainment and maintenance of the water quality standards of downstream waters. The components of Missouri's Water Quality Standards discussed in this section meet these requirements and are approved by the EPA. It is not the purview of a TMDL to revise existing water quality standards. In the event that future water quality monitoring demonstrates that water quality standards are not protective of downstream uses, the federal Clean Water Act provides means to address the situation. Such means are described in the EPA's Water Quality Standards Handbook.[8]

4.1 Designated Uses

Designated uses for a water body are defined in Missouri's Water Quality Standards at 10 CSR 20-7.031(1)(C) and assigned per 10 CSR 20-7.031(2) and Table H. These uses must be maintained in accordance with the federal Clean Water Act. The impaired segment of Stinson Creek has been assigned the following designated uses as described at 10 CSR 20-7.031(2)(E):

- Irrigation;
- Livestock and wildlife protection;
- Human health protection;
- Warm water habitat (aquatic life);
- Whole body contact recreation Category B; and
- Secondary contact recreation.

Stinson Creek is impaired due to nonattainment of the warm water habitat (aquatic life) use.

4.2 Water Quality Criteria

Water quality criteria are limits on certain chemicals or conditions in a water body to protect particular designated uses. Water quality criteria can be expressed as specific numeric criteria or as general narrative statements. Missouri 10 CSR 20-7.031(4) and (5) establish General Criteria applicable to all waters of the state at all times and Specific Criteria applicable to waters contained in 10 CSR 20-7.031 Tables G (Lakes) and H (Streams). Available data and field observations note water quality violations of general criteria associated with sediment loading as well as violations of the specific criterion for minimum dissolved oxygen concentrations in warm water habitats.

Excessive sediment deposition, either organic or inorganic, that results in bottom deposits that harm aquatic life or otherwise prevent the full maintenance of beneficial uses are violations of the general criteria specified at 10 CSR 20-7.031(4)(A) and (C). For streams designated for the protection of

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[8] https://www.epa.gov/wqs-tech/water-quality-standards-handbook

aquatic life associated with the warm water habitat use, Table A1 of 10 CSR 20-7.031 specifies a minimum criterion of 5.0 mg/L of dissolved oxygen.

The ultimate endpoint for this revised TMDL will be to meet Missouri Water Quality Standards through attainment of the minimum dissolved oxygen criterion of 5.0 mg/L and attainment of general criteria associated with waters free from excessive sedimentation. Compliance with these criteria will be determined in accordance with Department assessment procedures for federal Clean Water Act sections 305(b) and 303(d) reporting.

4.3 Antidegradation Policy

Missouri's Water Quality Standards include the EPA "three-tiered" approach to antidegradation, and may be found at 10 CSR 20-7.031(3).

Tier 1 – Protects public health, existing instream water uses, and a level of water quality necessary to maintain and protect existing uses. Tier 1 provides the absolute floor of water quality for all waters of the United States. Existing instream water uses are those uses that were attained on or after November 28, 1975, the date of EPA's first Water Quality Standards Regulation.

Tier 2 – Protects and maintains the existing level of water quality where it is better than applicable water quality criteria. Before water quality in Tier 2 waters can be lowered, there must be an antidegradation review consisting of: (1) a finding that it is necessary to accommodate important economic and social development in the area where the waters are located; (2) full satisfaction of all intergovernmental coordination and public participation provisions; and (3) assurance that the highest statutory and regulatory requirements for point sources and best management practices for nonpoint sources are achieved. Furthermore, water quality may not be lowered to less than the level necessary to fully protect "fishable/swimmable" uses and other existing uses.

Tier 3 – Protects the quality of outstanding national and state resource waters, such as waters of national and state parks, wildlife refuges and waters of exceptional recreational or ecological significance. There may be no new or increased discharges to these waters and no new or increased discharges to tributaries of these waters that would result in lower water quality.

Waters in which a pollutant is at, near, or exceeds the water quality criteria are considered in Tier 1 status for that pollutant. Therefore, the antidegradation goal for Stinson Creek is to restore water quality to levels that meet the water quality standards.

5. Defining the Problem

Eight water quality monitoring events were conducted in Stinson Creek between 1991 and 2018. Excessive organic sediment deposits (i.e., volatile suspended solids/sewage sludge) were observed during water quality monitoring conducted in 1991 and 1993. These observations resulted in Stinson Creek being placed on the 1994 303(d) List of impaired waters with the Fulton Wastewater Treatment Facility identified as the source of the pollutant. Stinson Creek was placed on the 2002 303(d) List due to violations of the minimum dissolved oxygen criterion of 5.0 mg/L, but no specific cause of the violations were identified. When Stinson Creek was listed on the 2008 303(d) List, the source of the pollutants contributing to low dissolved oxygen in the stream remained unknown.

In-stream dissolved oxygen and biochemical oxygen demand are affected by water temperature, the amount of decaying matter (i.e., organic sediment containing nutrients and oxygen consuming substances) in the stream, nutrient transport into streams from overland runoff, turbulence at the air-water interface, and the amount of photosynthesis occurring in plants within the stream. Nutrients (i.e., nitrogen and phosphorus) enter streams from wastewater effluent as well as from stormwater runoff. Benthic algae that adheres to large in-stream substrate can exert an influence on oxygen demand that results in wide daily dissolved oxygen fluctuations. Decaying matter can also accumulate on the bottom of a stream and cause sediment oxygen demand. Sediment oxygen demand is a combination of all of the oxygen-consuming processes that occur at or just below the sediment-water interface. Most of the sediment oxygen demand at the surface of the sediment is due to the biological decomposition of organic material and the bacterially facilitated nitrification of ammonia-nitrogen (NH_4-N).

Stream surveys were conducted near the outfalls of the minor non-municipal wastewater treatment facilities located upstream of the impaired segment in 2007 and 2013. At the time of the surveys, there was no continuous surface flow from the effluent outlets to Stinson Creek.

The impaired segment of Stinson Creek WBID 710 extends from 0.1 mile above the confluence of Youngs Creek upstream for 4.4 miles (Figure 1). This extent includes the upstream end of Stinson Creek as defined in Table H of Missouri's water quality standards, downstream to where available water quality data show attainment with Missouri's minimum dissolved oxygen criterion for the protection of warm water habitats as well as low concentrations of total suspended solids, an indicator of organic sediment loading. The downstream boundary was established based on available water quality data from monitoring locations near the confluence with Youngs Creek (Site ID 710/7.3) and 4.4 miles downstream on Stinson Creek (Site ID 710/2.9) where dissolved oxygen concentrations are greater than 5.0 mg/L and no violations of Missouri's water quality standards have been observed. Any water quality targets and pollutant reductions established in this revised TMDL to restore water quality in this impaired segment will also be protective of, and continue to maintain, attainment of water quality standards for the remaining downstream portions of WBID 710 and other downstream waters. Water quality data from the impaired segment of Stinson Creek, that were used in modeling for TMDL development (Section 7), is provided in Table 7. Data showing compliance with Missouri's minimum dissolved oxygen criterion downstream of the defined impaired segment is provided in Table 8. Locations of water quality sampling sites and major tributaries are presented in Figure 7.

Table 7. August 8, 2002 Water Quality Data in the Impaired Segment of Stinson Creek*

Site Code	Location	Time	Temp. (°C)	DO (mg/L)	TKN (mg/L)	NO_3 (mg/L)	TP (mg/L)
Sample Point 1							
710/11.2	Stinson Cr. 0.1 mi. above Fulton WWTF	7:32	18	4.0	1.16	23.5	<0.05
710/11.2	Stinson Cr. 0.1 mi. above Fulton WWTF	13:53	26	4.0	0.94	24.6	<0.05
Sample Point 2							
710/11.0	Stinson Cr. 0.1 mi. below Fulton WWTF	7:22	22	4.3	0.94	23.5	5.33
710/11.0	Stinson Cr. 0.1 mi. below Fulton WWTF	13:32	26	7.2	<0.2	24.6	5.12
Sample Point 3							
710/10.6	Stinson Cr. 0.5 mi. below Fulton WWTF	6:57	20	3.9	no data	23.4	5.84
710/10.6	Stinson Cr. 0.5 mi. below Fulton WWTF	13:10	25	12.9	<0.2	22.9	4.76

* Temp. = temperature; DO = dissolved oxygen; TKN = total kjeldahl nitrogen; NO_3 = nitrate; and TP = total phosphorus

Table 8. Dissolved Oxygen Data Recorded at 710/7.3 Located 3.8 miles Below the Fulton WWTF

Date	Time	Temp. (°C)	DO (mg/L)
10/25/1991	8:05	16	6.6
9/15/1993	14:55	22	12.3
9/15/1993	8:23	20	6.6
9/16/1993	14:20	24	12.2
9/16/1993	7:55	21	6.4
9/17/1993	14:30	23	12.2
9/17/1993	6:53	20	6.5

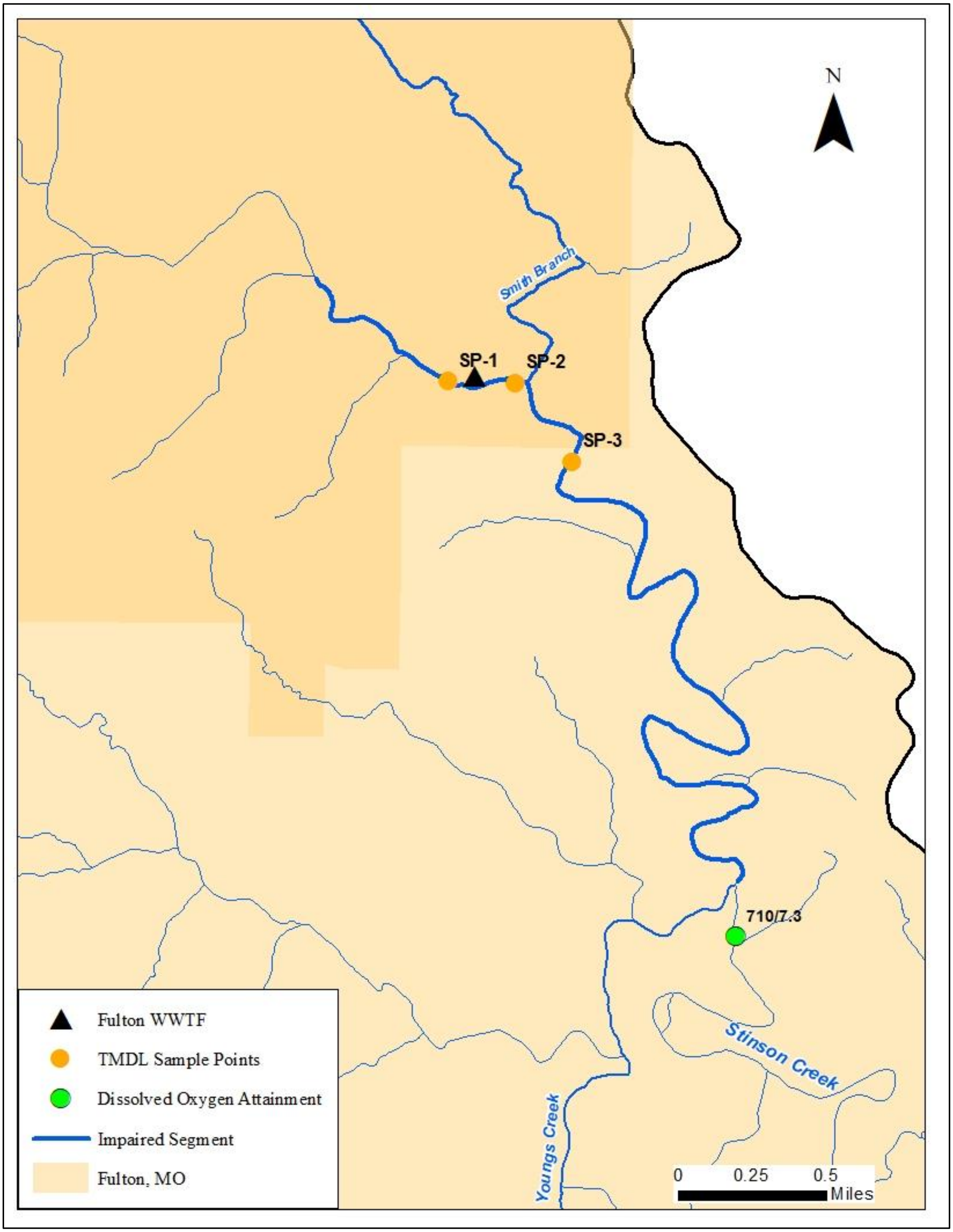

Figure 7. Stinson Creek Water Quality Sample Sites and Major Tributaries

6. Source Inventory and Assessment

Various sources may be contributing pollutant loading to Stinson Creek that impacts in-stream dissolved oxygen concentrations. For this reason, a source inventory and assessment is included in this TMDL report to identify and characterize known, suspected, and potential sources of pollutant loading to Stinson Creek. These sources are categorized as being either point (regulated) or nonpoint (unregulated).

6.1 Point Sources

Point sources are defined under Section 502(14) of the federal Clean Water Act and are typically regulated through the Missouri State Operating Permit program.[9] Point sources include any discernible, confined, and discrete conveyance, such as a pipe, ditch, channel, tunnel, or conduit, by which pollutants are transported to a water body. Under this definition, permitted point sources include site-specific permitted municipal and domestic wastewater dischargers, site-specific permitted industrial and non-domestic wastewater dischargers, concentrated animal feeding operations (CAFOs), MS4s, and general wastewater and stormwater permitted entities. In addition to these permitted sources, illicit straight pipe discharges, which are illegal and therefore unpermitted, are also point sources. As presented in Figure 8, permitted point sources in the Stinson Creek watershed include 11 municipal and domestic wastewater treatment facilities with site-specific permits, 7 general permitted dischargers, and 10 permitted stormwater dischargers.[10] In addition to these permitted activities, stormwater discharges from the City of Fulton are regulated through a small MS4 general permit. Likewise, stormwater discharges from highways and rights-of-way in Fulton are regulated through a site-specific MS4 permit issued to the Missouri Department of Transportation (MoDOT). There are no CAFO or site-specific permitted industrial or non-domestic dischargers in the Stinson Creek watershed.

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[9] The Missouri State Operating Permit Program is Missouri's program for administering the federal National Pollutant Discharge Elimination System (NPDES) program. The NPDES program requires all point sources that discharge pollutants to waters of the United States to obtain a permit. Issued and proposed operating permits are available online at dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/wastewater.

[10] Two facilities included in the original 2010 TMDL, Harbison-Walker Refractor (MO-0003018) and Calloway Raceway Wastewater Treatment Facility (MO-0125571), are no longer operating in the watershed and their permits have been terminated.

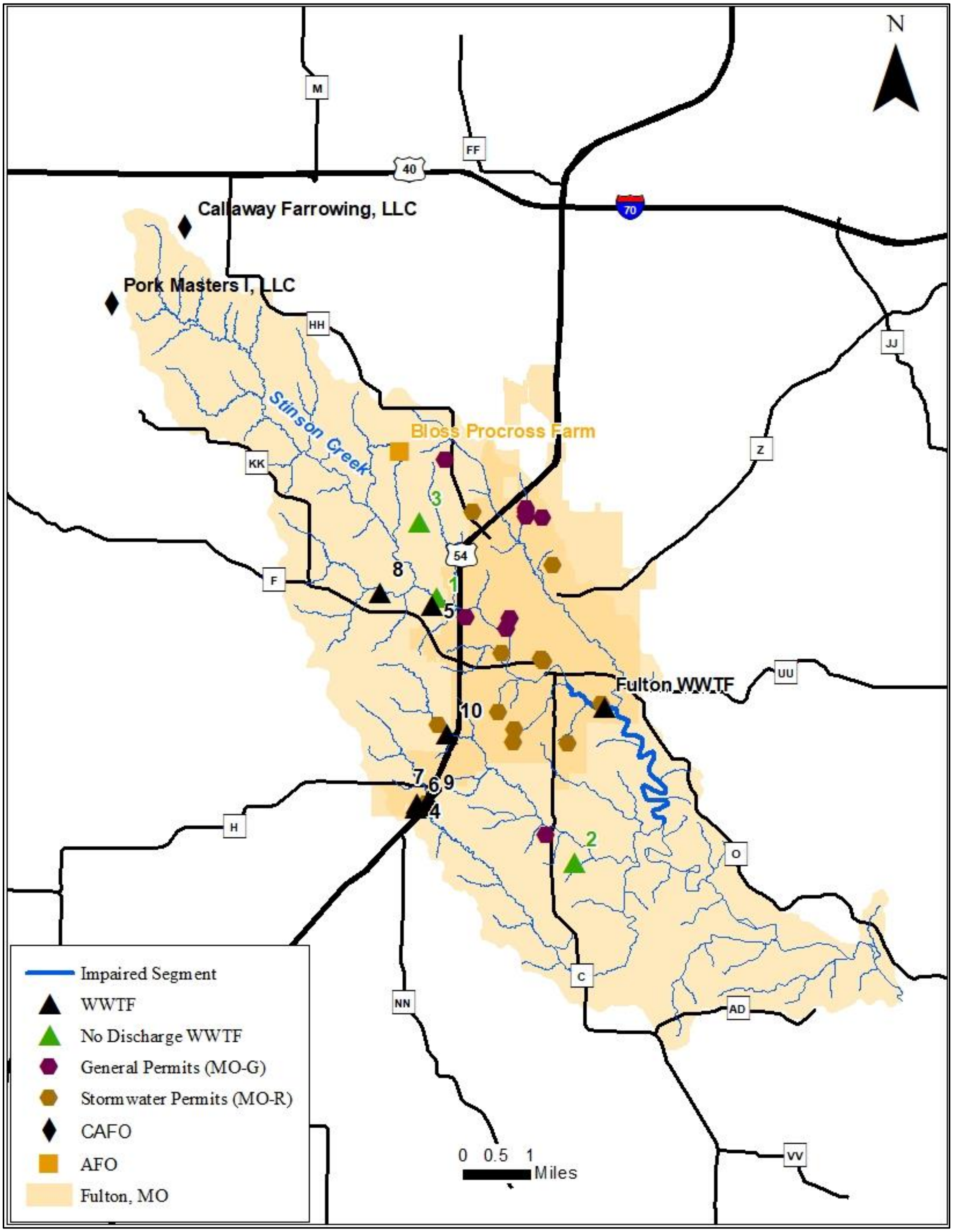

Figure 8. Point Sources in the Stinson Creek Watershed

6.1.1 Municipal and Domestic Wastewater Discharge Permits

Dischargers of domestic wastewater include both publicly owned municipal wastewater treatment facilities and private non-municipal treatment facilities. Domestic wastewater is primarily household waste, including graywater and sewage. Untreated or inadequately treated discharges of domestic wastewater can be significant sources of biochemical oxygen demand, nitrogen, and phosphorus to receiving waters. Influences of pollutant loading from domestic dischargers are typically most evident at low-flow conditions when stormwater influences are lower or nonexistent.

The Fulton Wastewater Treatment Facility (MO-0103331) is a major municipal wastewater treatment facility with a design flow of 2.93 MGD. Effluent from the Fulton facility discharges directly to the impaired segment of Stinson Creek. Water quality sampling and observations on Stinson Creek conducted between 1991 and 2007 found low dissolved oxygen, elevated total suspended solids, and excessive algae downstream of this facility. During low flows, effluent from the Fulton facility constitutes 99.6 percent of the flow in Stinson Creek.

There are also 10 minor non-municipal wastewater treatment facilities in the Stinson Creek watershed. Three of the facilities (Map IDs 1-3, Table 9) regularly report “no discharge” during summer months when critical low flow conditions are expected, and therefore do not cause or contribute to the Stinson Creek impairments. Surface water connections were not observed between two of the facilities (Map IDs 5 and 8) and Stinson Creek during stream surveys conducted in 2007 and 2013. The other five facilities discharge to tributaries that flow into Stinson Creek downstream of the impaired segment (Map IDs 4, 6, 7, 9, and 10). For these reasons, the facilities presented in Tables 9 and 10 do not cause or contribute to impairments in Stinson Creek. The design flow of these minor non-municipal facilities are expressed in gallons per day (GPD). In many cases actual facility flows are much less than stated design flows.

Table 9. Minor Non-Municipal Wastewater Treatment Facilities Reporting No Discharge

Map ID	Facility	Permit No.	Expires
1	Green Meadows Subdivision	MO-0093751	3-31-2025
2	Master Key Place Home Place Subdivision	MO-GD00512	6-30-2024
3	Tower Mobile Home Park WWTF	MO-0085936	3-31-2020

Table 10. Minor Non-Municipal Wastewater Treatment Facilities

Map ID	Facility	Permit No.	Design Flow (GPD)	Expires
4	Callaway Christian Church WWTF	MO-0124290	750	3-31-2020
5	Christopher Subdivision #2	MO-0093742	7,400	3-31-2020
6	Country Livin' Subdivision	MO-0102148	5,200	3-31-2025
7	Pass N Gas	MO-0093882	11,600	3-31-2025
8	Red Creek Estates	MO-0128104	7,493	3-31-2025
9	Red Maples WWTF	MO-0049590	37,000	3-31-2025
10	Stonehaven Estates WWTF	MO-0129020	30,000	3-31-2025

In addition to the direct discharges from domestic wastewater treatment facilities, potential pollutant contributions may also occur from overflows occurring from the adjoining sanitary sewer system. A sanitary sewer system is a wastewater collection system designed to convey domestic, commercial, and industrial wastewater to the treatment facility. This system can include limited amounts of inflow and infiltration from groundwater and stormwater, but it is not designed to collect large amounts of runoff from precipitation events. Untreated or partially treated discharge from a sanitary sewer system is referred to as a sanitary sewer overflow. Sanitary sewer overflows may result from blockages, line breaks, and sewer defects that allow excess stormwater and groundwater to enter and overload the collection system. Additionally, sanitary sewer overflows can result from lapses in sewer operation and maintenance, inadequate sewer design and construction, power failures, and vandalism. Sanitary sewer overflows can occur during either dry or wet weather and at any point in the collection system including overflows from manholes or backups into private residences. Such overflows may discharge directly to nearby waterways, or may be restricted to terrestrial locations. These types of discharges are unauthorized by the federal Clean Water Act, and should remain rare, and be eliminated to the maximum extent possible.

According to a review of sanitary sewer overflow records, the Fulton Wastewater Treatment Facility has reported overflows 120 times since 2014. The 120 reported overflows included some high precipitation events and associated stormwater runoff, which flooded manholes. Temporary stormwater inundation events may not contribute to dissolved oxygen impairments in Stinson Creek. In accordance to Missouri RSMO 644.026.1.(15) and 40 CFR Part 122.41(e) the permittee is required to develop and implement a program for maintenance and repair of collection systems, this is implemented through a special permit condition or schedule of compliance. The Fulton Wastewater Treatment Facility is under a schedule of compliance to meet and maintain these requirements through system upgrades as necessary to maintain the protection of aquatic life in Stinson Creek.

6.1.2 Site-Specific Industrial and Non-Domestic Wastewater Permits

Industrial and non-domestic facilities discharge wastewater resulting from non-sewage generating activities. There are no site-specific industrial or non-domestic wastewater permits in the Stinson Creek watershed.

6.1.3 CAFO Permits

Animal wastes generated from CAFOs that are used as fertilizer can be a source of bacteria to water bodies (Rogers and Haines 2005). Pursuant to 10 CSR 20-6.300, permits are required for CAFOs that confine and feed or maintain more than 1,000 animal units for 45 days or more during any 12-month period.[11] Permits may be required for facilities with fewer animal units if pollutants are discharged directly into waters of the state or other water quality issues are discovered. In Missouri, CAFOs operate under site-specific permits or one of two general permits (MO-G01 or MO-GS1).[12]

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[11] Per 10 CSR 20-6.300(1)(B)2, An animal unit is a unit of measurement to compare various animal types at an animal feeding operation. One (1) animal unit equals the following: 1.0 beef cow or feeder, cow/calf pair, veal calf, or dairy heifer; 0.5 horse; 0.7 mature dairy cow; 2.5 swine weighing over 55 pounds; 10 swine weighing less than 55 pounds; 10 sheep, lamb, or meat and dairy goats; 30 chicken laying hens or broilers with a wet handling system; 82 chicken laying hens without a wet handling system; 55 turkeys in grow-out phase; 125 chicken broilers, chicken pullets, or turkey poults in brood phase without a wet handling system.

[12] Process wastes are collected and reused as fertilizer by spreading onto agricultural fields at agricultural rates. The MO-GS1 does not authorize any direct discharges. The MO-G01 allows discharge only in the event of weather that exceeds the criteria of a

Permitted land application areas for Callaway Farrowing, LLC (MO-GS10485) and Pork Masters I, LLC (MO-GS10096) are located within the Stinson Creek watershed. Land application areas are where animal processing wastes are reused as soil amendments on agricultural fields. Under the MO-GS1 permit, CAFO facilities are not allowed to discharge for any reason, without exception, and any discharge is a violation. Animal waste applied on areas under the control of a CAFO are subject to conditions found in the permit, which include a nutrient management plan developed by the facility. Section 640.760 RSMo establishes setback distances for surface application of liquefied manure from a CAFO by a third party.[13] Pursuant to Section 640.760 RSMo, the Department may enforce stricter setbacks. For these reasons, manure application conducted by the CAFO facilities in compliance with permit conditions should not contribute significant bacteria loads to water bodies in the Stinson Creek watershed.

6.1.4 Municipal Separate Storm Sewer System (MS4) Permits

An MS4 is a stormwater conveyance system owned by a public entity that is not a combined sewer or part of a sewage treatment plant. Federal regulations issued in 1990 require discharges from such systems to be regulated by permits if the population of a municipality, or in some cases a county, is 100,000 or more. In 1999, new federal regulations required permits for discharges from small MS4s that are located within a U.S. Census Bureau defined urban area or have otherwise been designated as needing a permit by the permitting authority. Pollutant loading from these areas would be similar to nonpoint sources occurring through stormwater runoff (e.g., fertilizers from lawns, erosion, and yard debris) and potentially from sanitary sewer overflows entering the system. Although stormwater discharges are often untreated, MS4 permit holders must develop, implement, and enforce stormwater management plans to reduce the contamination of stormwater runoff and prohibit illicit discharges. These plans must include measurable goals, be reported on annually, and meet six minimum control measures. These six minimum control measures are public education and outreach, public participation and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, and pollution prevention.

There are two applicable MS4 permits in the Stinson Creek watershed (Table 11). Stormwater discharges from the City of Fulton are regulated through a general stormwater permit and stormwater discharges from highways and rights-of-way managed by MoDOT in Fulton are regulated through a site-specific permit. The site-specific permit is applicable to all MoDOT maintained highways and rights-of-way in MS4 urban areas statewide and is commonly referred to as a transportation separate storm sewer system (TS4).

Table 11. Permitted MS4s in the Stinson Creek Watershed

Facility	Permit No.	Expires
Fulton Small MS4	MO-R040061	9/30/2021
MoDOT TS4	MO-0137910	10/31/2021

catastrophic storm, and only authorizes discharge of the portion of stormwater flow that exceeds the design storm event, which includes the direct precipitation and runoff from the 25-year, 24-hour storm event.

[13] Section 640.760 RSMo setback distances are: 50 feet from a property boundary, 300 feet from any public drinking water lake, 300 feet from any public drinking water intake structure, 100 feet from any perennial and intermittent streams without vegetation abutting such streams, and 35 feet from any perennial and intermittent streams with vegetation abutting such streams.

Urban stormwater runoff can contain high levels of nitrogen and phosphorus that may result in nutrient loading to streams, which may contribute to excess algae growth and low dissolved oxygen conditions. During low precipitation and critical low flows, nutrients originating from fertilizer placed on residential lawns, cemeteries, parks, and other vegetated areas may be transported into storm sewers via runoff from sprinkler irrigation. Hobbie et al. (2017) found that pet (dog) waste may contribute 76 percent of total phosphorus inputs and 28 percent of total nitrogen inputs in urban areas. Hobbie et al. (2017) also found that export of phosphorus contributes 32 to 68 percent of storm drain nutrient outputs. Phosphorus transport is especially high in urban areas due to impervious surfaces which inhibit infiltration of soluble phosphorus and the phosphorus-laden runoff is carried to storm drains. In contrast, nitrogen transport is inhibited by up to 83 percent retention in unfertilized parks and storm drain catch basins and pipes.

The Fulton municipal area accounts for approximately 21.4 percent of the total watershed area. Developed land, which includes areas that are 20 to 80 percent impervious, covers 14 percent of the Stinson Creek watershed (Section 3.4). Degradation of water quality associated with imperviousness typically occurs in watersheds with at least 10 percent total imperviousness (Arnold and Gibbons 1996; Schueler 1994). Of the total developed land, 49 percent drains to the Smith Branch subwatershed, and is transported into Stinson Creek downstream of the Fulton Wastewater Treatment Facility. Water quality data for Stinson Creek show low dissolved oxygen concentrations in the City of Fulton upstream of the Fulton Wastewater Treatment Facility, and calibration of the QUAL2K model required pollutant inputs from the Smith Branch subwatershed. This indicates that portions of the watershed within the Fulton municipal area likely contribute pollutant loading to the impaired segment of Stinson Creek during critical low-flow conditions. In areas serviced by the MS4, such loading may result from residential activities such as lawn irrigation and car washing.[14]

The area potentially contributing runoff to the MoDOT TS4 in Fulton is 0.6 square miles and is comprised primarily of highways. This accounts for only 1.3 percent of the total watershed area. Due to the small amount of area draining to the TS4, and the lack of sources likely to contribute significant amounts of sediment or nutrients, the MoDOT TS4 does not cause or contribute to the impairment of Stinson Creek.

6.1.5 General Wastewater and Non-MS4 Stormwater Permits

General and stormwater permits are issued based on the type of activity occurring and are intended to be flexible enough to allow for ease and speed of issuance, while providing the required protection of water quality. General and stormwater permits are issued for activities similar enough to be covered by a single set of requirements and are designated with permit numbers beginning with “MO-G” or “MO-R,” respectively.

Facilities in the Stinson Creek watershed operate under the following General permits, as presented in Table 12:

- MO-G49 Stormwater and other specified discharges from limestone and other rock quarries, concrete, glass, and asphalt industries;
- MO-G84 Discharge of Stormwater, snowmelt, and infiltration water from a clay pit or mine; or

[14] Missouri’s general MS4 permit allows various non-stormwater discharges including, but not limited to, irrigation, street wash water, residential car washing, residential swimming pool discharges, and air conditioning condensate.

- MO-G92 Mixed feedstock composting operations under 20 acres; these operations are designed and operated as no-discharge facilities.

Table 12. General Permits in the Stinson Creek Watershed

Permit No.	Facility Name	Expires
MO-G920012	Bluebird Composting LLC	1/24/2023
MO-G840152	Craghead Property	6/29/2026
MO-G491295	Fred Weber Reinforced Concrete Products	4/30/2022
MO-G490549	Harbison Walker International Inc. Fulton	4/30/2022
MO-G491397	Harbison Walker International Fulton Rotary Kiln	4/30/2022
MO-G491346	Mid America Precast Inc.	4/30/2022
MO-G490763	MO CON Inc. of Fulton	4/30/2022

Facilities in the Stinson Creek watershed operating under stormwater permits are presented in Table 13. Permits associated with construction or land disturbance activities (MO-RA) are temporary. The number of effective permits of this type may vary widely in any given year. Despite this variability, final TMDL targets and allocations do not vary as a result of any changes in the numbers of these types of permits.

Table 13. Stormwater Permits in the Stinson Creek Watershed

Permit No.	Facility Name	Activity	Expires
MO-R100042	Callaway County	Land Disturbance by City or County	6/22/2022
MO-R60A381	Carls Towing LLC	Motor Vehicle Salvage	12/11/2023
MO-R100090	City of Fulton	Land Disturbance by City or County	6/22/2022
MO-RA09975	Dollar Tree Fulton MO	Construction or Land Disturbance	2/7/2022
MO-RA12970	Huey Construction	Construction or Land Disturbance	2/7/2022
MO-RA10515	Southwind Estates Plat 5	Construction or Land Disturbance	2/7/2022
MO-RA13212	Tanglewood	Construction or Land Disturbance	2/7/2022
MO-RA12194	Westminster College Muller Stadium	Construction or Land Disturbance	2/7/2022
MO-RA12270	Willow Creek Plat One	Construction or Land Disturbance	2/7/2022
MO-RA13433	Willow Creek Subdivision - Fulton	Construction or Land Disturbance	2/7/2022

For this Revised TMDL, the Department assumes the general and non-MS4 stormwater permits described in Tables 12 and 13, as well as any future general or stormwater permitted activities, will be conducted in compliance with all permit conditions, including monitoring and discharge limitations. It is expected that compliance with these permits will be protective of the applicable designated uses within the watershed. For these reasons, general wastewater and stormwater permits are not expected to cause or contribute to the aquatic life impairment of Stinson Creek. At any time, if the Department determines that the water quality of streams in the watershed is not being adequately protected, the Department may require the owner or operator of the permitted site to obtain a site-specific operating permit per 10 CSR 20-6.010(13)(C).

6.1.6 Illicit Straight Pipe Discharges

Illicit straight pipe discharges of domestic wastewater are also potential point sources of nutrients and oxygen consuming substances. These types of sewage discharges bypass treatment systems, such as a septic tank or a sanitary sewer, and instead discharge directly to a stream or an adjacent

land area (Brown and Pitt 2004). Illicit straight pipe discharges are illegal and not authorized under the federal Clean Water Act. At present, there are no data about the presence or number of illicit straight pipe discharges in the Stinson Creek watershed. For this reason, it is unknown to what significance straight pipe discharges contribute pollutant loads to Stinson Creek. Due to the illegal nature of these discharges, any identified illicit straight pipe discharges must be eliminated. Illicit discharge detection and elimination is one of the six minimum control measures required by an MS4 permit. Therefore, such sources in areas serviced by MS4s are expected to be detected and eliminated in accordance with existing permitted conditions.

6.2 Nonpoint Sources

Nonpoint source pollution refers to pollution coming from diffuse, non-permitted sources that typically cannot be identified as entering a water body at a single location and include all other categories of pollution not classified as being from a point source. Nonpoint sources are exempt from Department permit regulations per state rules at 10 CSR 20-6.010(1)(B)1. These sources involve stormwater runoff over land and are typically minor or negligible under low-flow conditions. However, sediment and organic material carried into streams during high precipitation events can accumulate in the receiving streambed. Decomposition of these accumulations can contribute to increased oxygen demand during low-flow conditions when water temperatures are warmer and flowing too slowly for adequate reaeration. Runoff from agricultural areas and non-MS4 permitted urban areas, onsite wastewater treatment systems, and areas with poor riparian corridor conditions are typical sources of nonpoint pollutants that contribute to water quality impairments.

6.2.1 Agricultural Runoff

Stormwater runoff and soil erosion from lands used for agricultural purposes (hay and pasture, and cropland) are sources of sediment and nutrient loading. Nitrogen and phosphorus may be applied to agricultural lands as chemical fertilizers or from land applications of manure from animal feeding operations (AFOs) that are not regulated by the Department through permits. Application rates and timing vary by site depending upon a number of factors, including manure quality and soil fertility. Manure from grazing livestock may also contribute nutrient loading via stormwater runoff, and animals that are not excluded from streams may deposit manure directly into waterways. Operations using nutrient management plans to guide fertilizer applications and employ best management practices to reduce soil erosion and exclude animals from streams will contribute smaller nutrient and sediment loads than those that do not.

In addition to potential runoff contributions, unpermitted AFOs may in some cases act like point sources and discharge animal waste directly to surface waters. In the Stinson Creek watershed, the Bloss Procross Farm AFO is a known source of direct discharge to surface waters. This dairy facility is located northeast of the City of Fulton and has intermittently discharged animal waste to a tributary of Stinson Creek (Figure 8). The Department's Northeast Region Office completed an emergency investigation of this facility on February 22, 2016, and found it to be operating in significant non-compliance. Notice of violations were issued to the facility and the facility was referred to the Department's Water Protection Program, Compliance and Enforcement Section. On March 3, 2018 an Abatement Order on Consent became effective. The case was referred to the Missouri Attorney General's Office on October 17, 2019 for violating the terms of the abatement order and continued water quality standard violations. Due to the known unpermitted discharges to

the tributary of Stinson Creek, the Bloss Procoss Farm is a potential contributor of pollutants to the impaired segment of Stinson Creek.

Ninety (90) percent of soils in the Stinson Creek watershed have moderate to high runoff potential at some time of the year, and agricultural areas (cropland and pastureland) account for nearly 50 percent of the watershed. Nutrient runoff from agricultural areas may contribute to low dissolved oxygen concentrations upstream of the Fulton Wastewater Treatment Facility. However, the City of Fulton urban area is also upstream of the Facility. Available data indicate pollutant loading from the Smith Branch subwatershed contributes to the Stinson Creek impairment downstream of the Fulton Wastewater Treatment Facility. The lower 68 percent of the Smith Branch subwatershed is contained within the City of Fulton MS4, and the upper 32 percent is agricultural lands. Because of data limitations and the wide variability of stormwater discharges, it is not possible to discern or separate the urban stormwater discharges that are subject to MS4 permitting from agricultural runoff that is not subject to permitting. However, as presented in Section 9, nonpoint source load allocations and MS4 wasteload allocations were derived based on the percentages of land outside the Fulton municipal area and within the municipal area. Downstream of the City of Fulton, nutrient loading and soil erosion are mitigated by a wide forested riparian buffer along the impaired segment of Stinson Creek (Figure 6 and Section 6.2.4).

6.2.2 Unregulated Urban Runoff

The primary source of urban runoff in the watershed is from the City of Fulton. As mentioned previously, stormwater discharges from Fulton are regulated by a MS4 permit. For this reason, there are minimal unregulated urban runoff contributions to the impaired segment of Stinson Creek. Unregulated urban runoff sources do not cause or contribute to the impairment of Stinson Creek.

6.2.3 Onsite Wastewater Treatment Systems

Approximately 25 percent of homes in Missouri utilize onsite wastewater treatment systems, particularly in rural areas where public sewer systems may not be available (DHSS 2018). Onsite wastewater treatment systems treat domestic wastewater and disperse it on the property from where it is generated (i.e., a home septic system). When properly designed and maintained, such systems perform well and should not serve as a source of contamination to surface waters. However, onsite wastewater treatment systems can fail for a variety of reasons. When these systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration), there can be adverse effects to surface water quality (Horsley and Witten 1996). Failing onsite wastewater treatment systems can contribute nutrient loads and oxygen consuming substances to nearby streams under wet or dry weather conditions through surface runoff and groundwater flows. Onsite wastewater treatment systems may contribute pollutants to waterbodies directly or as component of stormwater runoff.

The exact number of onsite wastewater treatment (septic) systems in the Stinson Creek watershed is unknown. EPA's online input data server for the Spreadsheet Tool for Estimating Pollutant Load (STEPL) provides estimates of septic system numbers and population per system by 12-digit HUC watersheds based on 1992 and 1998 data from the National Environmental Service Center (USEPA 2014b).[15] Estimates of septic system numbers for 12-digit HUC 103001021508 are presented in

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[15] The National Environmental Services Center is located at West Virginia University and maintains a clearinghouse for information related to, among other things, onsite wastewater treatment systems. Available URL: www.nesc.wvu.edu/

Table 14. The statewide estimated failure rates were estimated from a study by the Electric Power Research Institute (EPRI 2000). The study suggests that in some areas in Missouri, up to 50 percent of onsite wastewater treatment systems may be failing. Although failing onsite wastewater treatment systems are potential sources of nutrient loading, the significance of such contributions to the impaired segment of Stinson Creek is likely minimal. Due to the location of the impaired segment in relation to the City of Fulton, which has an available sewer system and wastewater treatment, onsite wastewater treatment systems are not expected to be a major contributor to the impairment in Stinson Creek.

Table 14. STEPL Derived Estimates of Septic System Number in the Stinson Creek Watershed

Population per System	Number of Systems	Potential Failure Rates
3	1,353	30 – 50%

6.2.4 Riparian Corridor Conditions

Riparian corridor conditions have a strong influence on instream water quality. Wooded riparian buffers are a vital functional component of stream ecosystems and are instrumental in the detention, removal and assimilation of pollutants in runoff. Therefore, a stream with good riparian cover is often better able to mitigate the impacts of high pollutant loads than a stream with poor or no riparian cover. Shade provided by riparian corridors is also important because it helps to keep water cooler and reduce temperature variation especially during the critical low flows of July and August.

Table 15 presents land cover calculations for the area within 100 feet of the impaired segment of Stinson Creek. Forest cover constitutes over 95 percent of the riparian corridor, which means that the detention, removal, and assimilation of nonpoint pollutants is likely very high. The presence of shade reduces temperature variation throughout the day.

Table 15. Land Cover within 100 feet of the Impaired Segment and Tributaries

Land Cover	Area (acres)	Percent
Developed	0.65	0.60%
Cultivated Crops	0.06	0.06%
Hay and Pasture	1.90	1.76%
Forest	103.0	95.5%
Shrub and Herbaceous	2.20	2.04%
Wetlands	0.01	0.01%
Total	107.82	100%

7. Numeric TMDL Targets and Modeling Approach

The pollutant targets in this revised TMDL have been established such that dissolved oxygen concentrations in Stinson Creek will meet the minimum criterion of 5.0 mg/L and the warm water habitat (aquatic life) designated use will be restored. Since dissolved oxygen is not a pollutant and cannot be allocated in a TMDL, other numeric targets that will result in attainment of the water quality standards identified in Section 4 of this document have been selected to address the low dissolved oxygen impairment. These targets include total nitrogen, total phosphorus, biochemical oxygen demand, and ammonia nitrogen. Applicability and support for the selected targets to achieve Missouri's dissolved oxygen criterion are provided using a QUAL2K model. An additional total suspended solids target is included in this TMDL to address violations of the general criteria associated with excess sedimentation (organic sediment). The load duration curve approach was

used to calculate acceptable loading and allocations of total suspended solids. The inclusion of a total suspended solids target addresses organic loading that may occur from point source discharges, as well as additional inorganic sediment and nutrient loading from nonpoint sources.

7.1 Organic Sediment and Nutrients

Sediment transported into streams from point sources and nonpoint sources contains nitrogen and phosphorus (nutrients/organic material) and results in the depletion of dissolved oxygen concentrations as oxygen is used to facilitate the biochemical processes of decomposition. In the presence of organic sediment and nutrients, dissolved oxygen in the stream is consumed faster than it can be replenished through atmospheric oxygen exchange and aquatic organism photosynthesis. This results in low dissolved oxygen until the organic matter has decomposed enough that dissolved oxygen replenishment exceeds dissolved oxygen consumption.

7.2 Total Suspended Solids

Total suspended solids are solids that are suspended (i.e., floating) in stream water or wastewater effluent and include both inorganic and organic sediments. Total suspended solids are comprised of both inorganic solids such as gravel and sand, as well as decomposable organic solids such as sewage particulates. Point sources reduce or remove total suspended solids through filtration of effluent, while nonpoint sources reduce total suspended solids through control of sediment erosion using best management practices. Because phosphorus can adhere to soil carried in runoff and organic sediment is a component of total suspended solids, reductions in total suspended solids are expected to result in additional nutrient and organic loading reductions that impact overall instream dissolved oxygen concentrations.

7.3 Biochemical Oxygen Demand

Biochemical oxygen demand is representative of both the quantity of oxygen demanding materials in effluent and the concentration of dissolved oxygen in the receiving stream. Biochemical oxygen demand is composed of carbonaceous biochemical oxygen demand (CBOD) (i.e., the amount of oxygen needed for the microbial utilization of carbon compounds) and nitrogenous biochemical oxygen demand (as NBOD) (i.e., the amount of oxygen needed for the microbial oxidation of certain nitrogen compounds). Nitrogenous biochemical oxygen demand is estimated directly from Total Kjeldahl Nitrogen (TKN), which is ammonia nitrogen (NH_4-N) plus organic nitrogen.

7.4 Ammonia as Nitrogen (NH_4-N)

Ammonia nitrogen can influence water quality in natural systems in two ways. The nitrification process in which ammonia nitrogen is reduced to nitrate (NO_3) consumes an estimated 4.2-4.6 grams of oxygen as O_2 per gram of ammonia as NH_4 (Cox 2003). High ammonia nitrogen concentrations in wastewater effluent exert a high oxygen demand (NBOD) that can contribute to low dissolved oxygen in receiving streams. In addition to depleting oxygen, ammonia can be toxic to aquatic life and must not exceed the concentrations found in Tables B1 and B2 of Missouri's Water Quality Standards. Water quality targets for ammonia nitrogen must be protective of both possible pathways.

7.5 QUAL2K Modeling

QUAL2K is a steady state model based on the Streeter-Phelps equation that estimates the effects of point source biochemical oxygen demand from sewage effluent on receiving stream dissolved oxygen concentrations. QUAL2K simulates the link between dissolved oxygen and biochemical

oxygen demand. The QUAL2K model calculates biochemical oxygen demand by using CBOD, organic nitrogen, and ammonia nitrogen data from the wastewater treatment facility's discharge monitoring report and produces estimates of in-stream dissolved oxygen concentrations.

Two QUAL2K models, a calibration model and a critical condition model, were developed to determine allowable pollutant loading in Stinson Creek. For the calibration model, observed data are used to adjust the model to simulate stream characteristics. The calibration model inputs were based on data recorded at three sample points along Stinson Creek on August 8, 2002. Data available from this date represent the most recent water quality data from the impaired segment where the time of sampling captured critical low dissolved oxygen conditions. [16] These data are summarized in Table 7 and Appendix A.

The critical condition model uses the calibrated stream characteristics to simulate a low-flow critical condition when the Fulton Wastewater Treatment Facility is expected to be the predominant source of flow in Stinson Creek, and in-stream conditions are most likely to result in low dissolved oxygen conditions. The 2021 QUAL2K critical condition model demonstrates that when wasteload allocations are applied to the Fulton Wastewater Treatment Facility, Missouri Water Quality Standards are attained in the impaired segment and existing compliance downstream is maintained. Wasteload allocations result in attainment of the minimum dissolved oxygen criterion under low-flow critical conditions, and are also expected to result in attainment of the minimum dissolved oxygen criterion under other flow conditions when additional reaeration through turbulence and increased pollutant dilution are more likely. Model assumptions, tables of model inputs, and graphical model outputs are provided in Appendix A.

7.6 Total Suspended Solids Load Duration Curve

The load duration curve approach was used to calculate the allowable loading of total suspended solids into Stinson Creek. The load duration approach provides a visual representation of stream flow conditions and the pollutant loading that will attain surface water quality targets during those flow conditions. When observed data from the impaired water body is available, the load duration curve approach is also useful in identifying and differentiating between storm-driven and steady-input sources, which can then inform appropriate restoration actions. To develop the total suspended solids load duration curve for Stinson Creek, a flow duration curve was developed using a synthetic flow record derived from the average daily flow data collected from multiple USGS stream gages in the EDU where Stinson Creek is located. For this TMDL, the targeted pollutant loading for total suspended solids is based on the 25th percentile concentration of all USGS total suspended solids data available from Missouri in the EDU for which Stinson Creek is located. The concentration target calculated using this approach is 5 mg/L. Additional discussion about the methods used in the modeling and development of the total suspended solids load duration curve for Stinson Creek is presented in Appendix B.

8. Calculating Loading Capacity

A TMDL calculates the loading capacity of a water body and allocates that load among the various pollutant sources in the watershed. The loading capacity is the maximum pollutant load that a water

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[16] Water quality data collected in the impaired segment of Stinson Creek in September 2018 did not include samples taken in the morning when dissolved oxygen concentrations are lowest. Water quality sample points where data were collected in Stinson Creek in August 2007 were not located on the impaired segment of Stinson Creek.

body can assimilate and still meet water quality standards. The TMDL is equal to the sum of the wasteload allocations, load allocations, and the margin of safety:

$$TMDL = LC = \Sigma WLA + \Sigma LA + MOS$$

where LC is the loading capacity, ΣWLA is the sum of the wasteload allocations, ΣLA is the sum of the load allocations, and MOS is the margin of safety.

The following formula is used to convert pollutant concentrations to pounds/day:

(flow in ft^3/sec)(maximum allowable pollutant concentration in mg/L)(5.395*)= pounds/day
*5.395 is the conversion factor used to obtain units of pounds/day.

For this TMDL, the pollutant loading capacity for biochemical oxygen demand, nutrients, and ammonia as nitrogen were calculated at critical low-flow conditions when in-stream conditions are most likely to result in violations of Missouri’s dissolved oxygen criterion due to increased temperature, and limited dilution and flow. The loading capacity of these pollutants is equal to the sum of the nonpoint source load allocation and the sum of wasteload allocations to the Fulton Wastewater Treatment Facility and Fulton MS4. An implicit margin of safety was used for all TMDL calculations as described in Section 11. The pollutant loading capacity and allocations for the impaired segment of Stinson Creek during critical low-flow conditions are presented in Tables 16 and 17. The loading capacity for total suspended solids was calculated using a load duration curve (Figure 9), and allocations at various flows are presented in Table 18. Additional discussion regarding specific allocations of pollutant loading capacities and margin of safety is provided in Sections 9, 10, and 11.

Table 16. Critical Low Flow (7Q10) TMDL for Stinson Creek

Pollutant	Loading Capacity (lbs/day)	∑Wasteload Allocation (lbs/day)	∑Load Allocation (lbs/day)
BOD_5	60.63	59.55	1.079
$CBOD_5$[17]	45.66	44.85	0.813
TP	12.27	12.23	0.041
TN	244.83	244.45	0.380

Table 17. Typical Low Flow (90% Flow Exceedance) TMDL for Stinson Creek

Pollutant	Loading Capacity (lbs/day)	∑Wasteload Allocation (lbs/day)	∑Load Allocation (lbs/day)
BOD_5	129.48	74.02	55.46
$CBOD_5$[14]	97.52	55.75	41.77
TP	14.87	12.77	2.10
TN	269.05	249.54	19.51

[17] The Fulton Wastewater Treatment Facility specifically measures carbonaceous biochemical oxygen demand ($CBOD_5$). The BOD_5/$CBOD_5$ ratio is 1.33 based on EPA Region 7 calculations for the Fulton Wastewater Treatment Facility (Steven Wang slide presentation December 15, 2020).

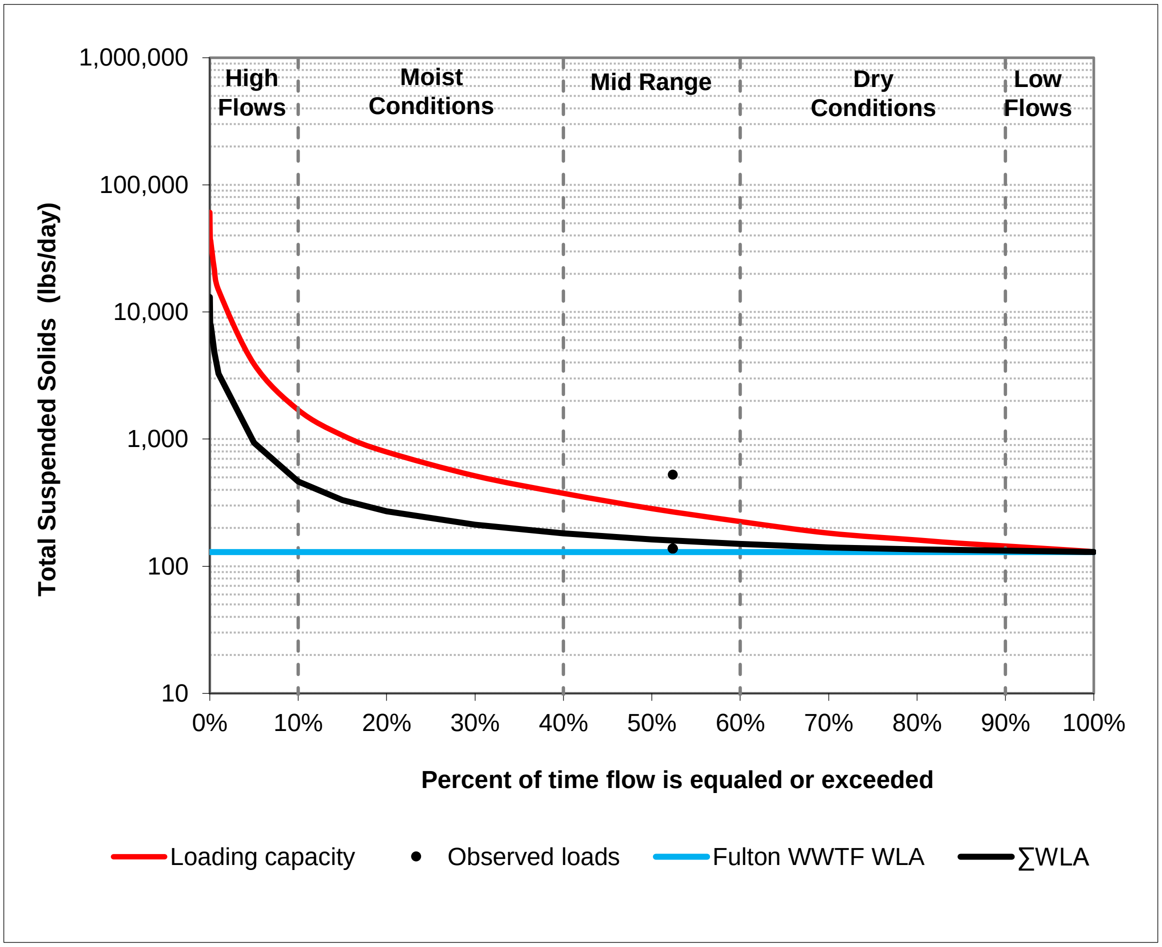

Figure 9. Total Suspended Solids Load Duration Curve

Table 18. Total Suspended Solids TMDL and Allocations at Various Flows

Percent of time flow equaled or exceeded	Flow (cfs)	Loading Capacity (lbs/day)	∑Wasteload Allocation (lbs/day)	∑Load Allocation (lbs/day)
95	5.1	137	131	6
75	6.3	171	138	33
50	10.5	284	162	122
25	23.4	632	234	398
5	144.4	3,894	915	2,979

9. Wasteload Allocation (Allowable Point Source Load)

The wasteload allocation is the allowable amount of the loading capacity assigned to existing or future point sources. This section discusses the rationale and approach for assigning wasteload allocations to point sources in the Stinson Creek watershed as well as considerations given for future sources. Typically, point source permit limits for a given pollutant are the most stringent of either technology-based effluent limits or water quality-based effluent limits. Technology-based effluent limits are based upon the expected capability of a treatment method to reduce the pollutant to a certain concentration. Water quality-based effluent limits represent the most stringent concentration of a pollutant that a receiving stream can assimilate without violating applicable water quality standards at a specific location. Final effluent limits or other permit conditions must be consistent with the assumptions and requirements of TMDL wasteload allocations per 40 CFR 122.44(d)(1)(vii)(B). Mixing zones and zones of initial dilution are not allowed in regulation for streams with 7Q10 low flows of less than 0.1 cubic feet per second (cfs) [10 CSR 20-7.031(5)(A)4.B.(I)]. The Stinson Creek 7Q10 low flow, as estimated at the Fulton Wastewater Treatment Facility,[18] is 0.0182 cfs. Therefore, in order to ensure attainment of applicable water quality standards in Stinson Creek, all water quality targets must be met at end of pipe. The wasteload allocations in this TMDL report do not authorize any facility to discharge pollutants at concentrations that violate water quality standards.

9.1 Municipal and Domestic Wastewater Discharges

As discussed in Section 6.1.1, the Fulton Wastewater Treatment Facility is the only domestic wastewater discharge that influences water quality in Stinson Creek during critical low flows, and is the predominant source of pollutants during all flow regimes. The other wastewater treatment facilities in the Stinson Creek watershed either do not have surface water connections to Stinson Creek or discharge to tributaries that flow into Stinson Creek downstream of the impaired segment. The wasteload allocations for the Fulton Wastewater Treatment Facility, presented in Table 19, are based on the facility's design flow and appropriate pollutant concentration targets shown by QUAL2K to attain the minimum dissolved oxygen water quality criterion of 5.0 mg/L for the protection of warm water habitat, as well as an additional total suspended solids reference target derived to attain compliance with general criteria associated with organic sediment loading. Wasteload allocations to the Fulton Wastewater Treatment Facility are applicable at all flows. In addition to authorized discharges from municipal wastewater treatment facilities, areas serviced by sanitary sewer systems risk nutrient contributions from accidental overflows. As mentioned in Section 6.1.1 of this document, sanitary sewer overflows are unpermitted discharges and not

[18] Per StreamStats: Streamflow Statistics and Spatial Analysis Tools for Water-Resources Applications https://streamstats.usgs.gov/ss/

authorized under the federal Clean Water Act. For this reason, sanitary sewer overflows are assigned a wasteload allocation of zero.

Table 19. Wasteload Allocations for Domestic Wastewater Dischargers

Effluent Parameter	**Design Flow MGD**	**Existing Permit Limit**[19]		**WLA at Design Flow**		**Percent Reduction**
		Concentration mg/L	**Load lbs/day**	**Concentration mg/L**	**Load lbs/day**	
Fulton WWTF (MO-0103331)						
BOD_5	2.93	Monthly Average = 30	733	2.43	59.39	92%
$CBOD_5$	2.93	Monthly Average = 25	611	1.83	44.72	93%
NH_4-N	2.93	Monthly Average = 1.2	29	0.7	17.11	42%
Nitrate+Nitrite	2.93	No Existing Limit	No Data	9.3	227.29	No Data
TN	2.93	No Existing Limit	No Data	10.0	244.39	No Data
TP	2.93	No Existing Limit	No Data	0.5	12.22	No Data
TSS	2.93	Monthly Average = 30	733	5.0	122.20	83%
DO*	2.93	No Existing Limit	N/A	7.5	N/A	N/A
Other Permitted Domestic Wastewater Dischargers						
Effluent Parameter	**Design Flow MGD**	**Existing Permit Limit**		**WLA at Design Flow**		**Percent Reduction**
		Concentration mg/L	**Load lbs/day**	**Concentration mg/L**	**Load lbs/day**	
Same as above	0.25	N/A		Existing permit limits and conditions		N/A
Sanitary Sewer Overflows						
Illegal discharge				0		N/A

* Note: For water quality standards to be attained at specified wasteload allocations, Fulton WWTF effluent should be maintained to no less than 7.5 mg/L dissolved oxygen.

For point source reductions to achieve the specified loading targets, additional upgrades to the Fulton Wastewater Treatment Facility, such as biological or enhanced nutrient removal, may be necessary.

9.2 Site-Specific Permitted Industrial and Non-Domestic Wastewater Facilities

There are no site-specific permitted industrial and non-domestic wastewater facilities in the Stinson Creek watershed. Therefore, such sources are not assigned a portion of the calculated loading capacity.

[19] The current active permit for the Fulton Wastewater Treatment Facility (issued January 1, 2015, modified April 1, 2017, and expires on December 31, 2019) contains three phased interim effluent limits. The "Existing Permit Limits" shown in Table 19 reflect the final effluent limit for ammonia nitrogen which became effective on December 31, 2016 and interim effluent limits which became effective on January 1, 2015 and are to remain in effect through December 30, 2026.

9.3 CAFOs

Callaway Farrowing, LLC (MO-GS10485) and Pork Masters I, LLC (MO-GS10096) operate subject to permits that do not allow discharge to surface waters. For this reason, the *E. coli* wasteload allocations for all CAFO facilities are zero at all flows. When all permit conditions are met, including those associated with land application, CAFO facilities are not expected to contribute *E. coli* loads above *de minimis* concentrations to surface waters. Pollutant loading contributions from unpermitted AFO facilities are included within the total load allocation to nonpoint sources.

9.4 MS4 Permits

As mentioned in Section 6.1.4, urban runoff is a potential contributor of sediment and nutrient loading to streams. During periods of low precipitation and critical low flows, pollutants are transported into storm sewers from lawn irrigation and car washing on residential properties. The Fulton MS4 has been assigned wasteload allocations as presented in Tables 20 and 21, because water quality data for Stinson Creek showed low dissolved oxygen concentrations immediately upstream of the Fulton Wastewater Treatment Facility near the southeastern boundary of the MS4 area in August 2002, and because pollutants transported into Stinson Creek from Smith Branch originate primarily within the City of Fulton.

The Fulton MS4 critical low flow wasteload allocations were derived using 7Q10 flows estimated by the USGS StreamStats tool.[20] The Fulton MS4 typical low flow wasteload allocations were derived using the flow corresponding to the 90 percent flow exceedance from the synthetic flow duration curve used to develop the TSS loading capacity. The nitrogen and phosphorus wasteload allocations are based on recommended EPA Level III Ecoregion 40 concentrations for natural streams for (TN = 0.855 mg/L, TP = 0.092 mg/L), which although not directly tied to Missouri's dissolved oxygen criteria, are assumed to be protective of eutrophic conditions that may affect in-stream dissolved oxygen (USEPA 2000). Subwatersheds were delineated using StreamStats based on downstream points just upstream of the Fulton Wastewater Treatment Facility, upstream of the confluence of Smith Branch and Stinson Creek, and at the end of the assessment unit (WBID 710). The MS4 wasteload allocations are based on the percentage of Fulton MS4 area in each subwatershed. The Fulton MS4 TN and TP wasteload allocations in pounds per year are the EPA Level III Ecoregion nitrogen and phosphorus concentrations multiplied by the area corrected flows in cubic feet per second and a conversion factor of 5.395. The $CBOD_5$ and BOD_5 wasteload allocations are based on the CBOD concentration entered into the QUAL2K model used to determine the wasteload allocations for the Fulton Wastewater Treatment Facility using the same flows and conversion factor. Although the MS4 wasteload allocations are presented only at 7Q10 and 90 percent exceedance flows when the dissolved oxygen impairment is likely to occur, it is expected that instream pollutant reductions from sources originating in the MS4 area will target EPA Level III Ecoregion concentration targets during all flow conditions.

Fulton MS4 wasteload allocations for total suspended solids were derived for various flows using the load duration curve approach, and are presented in Table 22. Total suspended solids wasteload allocations are based on the proportion of entire municipal area in the watershed and available loading after allocations to the Fulton Wastewater Treatment Facility. Upon approval of this TMDL, the City of Fulton will be required by their permit to develop an Assumptions and

[20] Streamflow Statistics and Spatial Analysis Tools for Water-Resources Applications https://streamstats.usgs.gov/ss/

Requirements Attainment Plan for the MS4 to incorporate best management practices consistent with the goals of this TMDL. Best management practices that address the pollutants of concern addressed by this TMDL, which are implemented as part of MS4 permit requirements to reduce stormwater pollutant loading to the maximum extent practicable, will be consistent with the assumptions and requirements of this TMDL. Reduction of pollutant loading during stormwater discharges is expected to result in net pollutant reductions during critical low flow conditions. Required MS4 control measures, such as illicit discharge elimination, and public education and outreach, may be used to address additional non-stormwater generated pollutant loading that may occur during low flow conditions. Implementation of such measures is consistent with the assumptions and requirements of this TMDL.

The MoDOT TS4 receives runoff primarily from highways, accounts for only 1.3 percent of the total watershed area, and is not expected to contribute significant loads of sediment, nutrients, or oxygen consuming substances to Stinson Creek (Section 6.1.4). For this reason, no specific portion of the loading capacity is allocated to the MoDOT TS4. Existing permit conditions and continued implementation of required stormwater management programs are expected to result in *de minimis* pollutant loading that will not exceed the total wasteload allocation.

Table 20. Critical Low Flow (7Q10) MS4 Wasteload Allocations

Effluent Parameter	WLA	
	Concentration (mg/L)	Load (lbs/day)
BOD_5	2.43	0.165
$CBOD_5$	1.83	0.124
TP	0.092	0.006
TN	0.855	0.058

Table 21. Typical Low Flow (90% Exceedance) MS4 Wasteload Allocations

Effluent Parameter	WLA	
	Concentration (mg/L)	Load (lbs/day)
BOD_5	2.43	14.64
$CBOD_5$	1.83	11.02
TP	0.092	0.55
TN	0.855	5.15

Table 22. Total Suspended Solids Wasteload Allocations for the Fulton MS4 at Various Flows

Percent of time flow equaled or exceeded	Flow (cfs)	Loading Capacity (lbs/day)	MS4 Wasteload Allocation (lbs/day)
95	5.1	137	2
75	6.3	171	9
50	10.5	284	32
25	23.4	632	105
5	144.4	3,894	786

9.5 General Wastewater and Non-MS4 Stormwater Permits

Activities permitted through general or stormwater permits are not expected to contribute significant pollutant loads to surface waters. It is expected that compliance with these types of permits will be protective of the warm water habitat use designated to Stinson Creek. For this reason, these types of facilities are not assigned a specified portion of the calculated loading capacity and wasteload allocations are set at existing permit limits and conditions, which are assumed to result in pollutant loading at *de minimis* concentrations that will not exceed the total wasteload allocation.

9.6 Illicit Straight Pipe Discharges

Illicit straight pipe discharges are illegal and are not permitted under the federal Clean Water Act. For this reason, illicit straight pipe discharges are assigned a wasteload allocation of zero. Any existing sources of this type must be eliminated.

9.7 Considerations for Future Point Sources

For this TMDL, no specific portion of the loading capacity is allocated to a reserve capacity. However, the wasteload allocations presented in this TMDL report do not preclude the establishment of future point sources in the watershed. Any future point sources should be evaluated against the TMDL, the range of flows with which any additional loading will affect, and any additional requirements associated with antidegradation. Per federal regulations at 40 CFR 122.4(a), no permit may be issued when the conditions of the permit do not provide for compliance with the applicable requirements of the federal Clean Water Act, or regulations promulgated under the federal Clean Water Act. Additionally, 40 CFR 122.4(i) states no permit may be issued to a new source or new discharger if the discharge from its construction or operation will cause or contribute to violation of water quality standards. Facility types not currently existing in the watershed and not allocated a portion of the loading capacity may be permitted as no discharge facilities as long as permit conditions for land application or other controls maintain potential loading at *de minimis* concentrations. Future general (MO-G) and stormwater (MO-R) permitted activities that operate in full compliance with permit conditions are not expected to contribute pollutant loads above *de minimis* levels and will not result in loading that exceeds the sum of the TMDL wasteload allocations. Decommissioning of onsite wastewater treatment systems and home connection to a sewerage system for wastewater treatment will result in net pollutant reductions that are consistent with the goals of this TMDL. Wasteload allocations calculated for the Fulton Wastewater Treatment Facility are based on design flow instead of actual flow and will account for future discharge increases. Wasteload allocations between point sources may also be appropriately shifted between individual point sources where pollutant loading has shifted as long as the sum of the wasteload allocations is unchanged. In some instances a potential source may be re-categorized from a nonpoint source to a point source (e.g., newly designated MS4s or other permitted stormwater). If

such a source's magnitude, character, and location remain unchanged, then the appropriate portion of the load allocation may be assigned as a wasteload allocation.

10. Load Allocation (Nonpoint Source Load)

The load allocation is the amount of the pollutant load that is assigned to existing and future nonpoint sources, as well as natural background contributions (40 CFR 130.2(g)). Best management practices (BMPs) that reduce erosion and nutrient transport are recommended to reduce pollutant loading from the agricultural areas to Stinson Creek. For areas of the watershed draining to portions of Stinson Creek that are not impaired by low dissolved oxygen conditions, BMPs to maintain loading at current levels are also recommended.

The low flow nonpoint source load allocations for nitrogen and phosphorus in Tables 16 and 17 (Section 8) were derived using 7Q10 flows estimated by the USGS StreamStats tool, the flow corresponding to the 90 percent flow exceedance from the synthetic flow duration curve, and the recommended EPA Level III Ecoregion 40 criteria for natural streams. As discussed in Section 9.4, subwatersheds were delineated in StreamStats based on downstream points just upstream of the Fulton Wastewater Treatment Facility, at the confluence of Smith Branch and Stinson Creek, and at the end of the assessment unit (WBID 710). The loads allocated to nonpoint sources are based on the percentage of area not assigned to the Fulton MS4. The load allocations in pounds per year are the EPA Level III Ecoregion nitrogen and phosphorus concentrations multiplied by the area corrected flows in cubic feet per second and a conversion factor of 5.395. Although loading capacity and load allocations are presented only for low flow conditions when the dissolved oxygen impairment is likely to occur, it is expected that nonpoint source pollutant reductions in the watershed will target EPA Level III Ecoregion concentration targets during all flow conditions. The $CBOD_5$ and BOD_5 wasteload allocations are based on the CBOD concentration entered into the QUAL2K model used to determine the wasteload allocations for the Fulton Wastewater Treatment Facility using the same flows and conversion factor.

Load allocations for TSS are the remainder of the TSS loading capacity after allocations to the Fulton Wastewater Treatment Facility and the Fulton MS4 (Figure 9 and Table 18).

11. Margin of Safety

A margin of safety is required in the TMDL calculation to account for uncertainties in scientific and technical understanding of water quality in natural systems (CWA Section 303(d)(l)(C) and 40 C.F.R. 130.7(c)(l)). The margin of safety is intended to account for such uncertainties in a conservative manner. Based on EPA guidance, the margin of safety can be achieved through two approaches:

- Explicit - Reserve a portion of the loading capacity as a separate term in the TMDL.
- Implicit - Incorporate the margin of safety as part of the critical conditions for the wasteload allocation and the load allocation calculations by making conservative assumptions in the analysis.

For this TMDL an implicit margin of safety was used. The margin of safety was incorporated into the development of this TMDL by making conservative assumptions in the analysis as follows:

- The 7Q10 low flow value was used for the Headwater and Smith Branch flow rates in the low flow QUAL2K model.

- The wasteload allocations to the Fulton MS4 and load allocations to nonpoint sources are based on the recommended EPA Level III Ecoregion 40 criteria for natural streams.
- Total suspended solids targets are based on the 25th percentile concentration of all USGS total suspended solids data available from Missouri in the EDU in which Mound Branch is located. Additionally, because phosphorus can adhere to soil carried in runoff and organic sediment is a component of total suspended solids, reductions in total suspended solids are expected to result in additional nutrient and organic loading reductions that impact overall instream dissolved oxygen concentrations.

12. Seasonal Variation

Federal regulations at 40 CFR 130.7(c)(1) require that TMDLs take into consideration seasonal variation in applicable standards. This TMDL considered seasonal variation by assuming that the Fulton Wastewater Treatment Facility accounts for the majority of the flow in Stinson Creek during critical low-flow conditions. Critical low-flow conditions represent the highest stream temperatures and lowest flows, when assimilation of pollutants and reaeration of dissolved oxygen are the most difficult. It is expected that achievement of these wasteload and load allocations during other conditions not associated with summer low-flow critical conditions will also result in attainment of water quality standards. However, conservative assumptions and implicit margins of safety incorporated into the TMDL may allow for effluent quality at other times of the year (e.g., winter) that may also result in achievement of Missouri's minimum dissolved oxygen criterion. Such considerations for alternative effluent limitations during winter months when critical conditions are not as likely to occur must take into account available data associated with the parameters of concern, achievement of water quality standards in Stinson Creek, and must be consistent with the underlying model and assumptions of the TMDL. Missouri Water Quality Standards account for seasonal variation by establishing ammonia as nitrogen criteria based on pH and temperature such that the criteria are more stringent when water temperatures are higher. For total suspended solids, the load duration curve developed for this TMDL represents streamflow under all conditions as it was developed using numerous years of flow data collected during all seasons. For this reason, the total suspended solids targets and allocations found in this TMDL report will be protective of applicable general criteria during all seasons and under all flow conditions, including critical conditions associated with pollutant loading.

13. Monitoring Plans

The Department often schedules and carries out post-TMDL monitoring within a reasonable timeframe following completion of permit compliance schedules, facility upgrades, or the implementation of watershed BMPs. The Department and the City of Fulton are implementing a Memorandum of Understanding (MOU), which took effect in March 2014, and facilitated the approval of a Variance for the Fulton Wastewater Treatment Facility, which was approved by EPA in February 2015. The MOU and Variance resulted in a schedule of compliance for the January 1, 2015 operating permit for the Fulton Wastewater Treatment Facility that included interim effluent limits with final targets that are proportionate to the wasteload allocations established by the 2010 TMDL.

Attachment 1 of the MOU outlines an Implementation Schedule, which commences after certain improvements to the Fulton Wastewater Treatment Facility are completed. The Implementation Schedule established by the 2014 MOU called for field water quality studies to be completed by the Department in 2017 and 2018, followed by re-assessment of the water quality in Stinson Creek, and

potential removal of impairments from the Integrated Missouri Water Quality Report (305(b) Report). The Department conducted continuous (15-minute interval) dissolved oxygen concentration monitoring between August 17 and September 4, 2018. Over 10 percent of records showed dissolved oxygen concentrations less than 5.0 mg/L. However, 2018 was an abnormally dry year, and the data may not be representative of normal stream conditions. No new data were collected in 2019 due to flooding within the basins of the Missouri River and its tributaries. Additional data collection is tentatively scheduled for summer 2021. The timing and seasonality of future data collection is integral when re-assessing impaired water bodies.

The Department will make efforts to conduct field water quality studies that will yield data that represent the normal low flow condition of Stinson Creek. Data collected during such monitoring will be used to determine either attainment or continued impairment of water quality standards as part of the biennial water quality assessments required for federal Clean Water Act 305(b) and 303(d) reporting. The data derived from this monitoring may also be used for adjusting pollutant reduction goals and informing implementation activities. Furthermore, the Department will also routinely examine any available quality-assured water quality data collected from Stinson Creek by other local, state and federal entities in order to assess the effectiveness of TMDL implementation. In addition, certain quality-assured data collected by universities, municipalities, private companies, and volunteer groups may potentially be considered for monitoring water quality following TMDL implementation.

14. Reasonable Assurance

Section 303(d)(1)(C) of the federal Clean Water Act requires that TMDLs be established at a level necessary to implement applicable water quality standards. As part of the TMDL process, consideration must be given to the assurances that point and nonpoint source allocations will be achieved and water quality standards attained. Where TMDLs are developed for waters impaired by point sources only, reasonable assurance is provided through the NPDES permitting program. State operating permits requiring effluent and instream monitoring be reported to the Department should provide reasonable assurance that instream water quality standards will be met. The Department regulates point source discharges from the Fulton Wastewater Treatment Facility through Missouri State Operating Permit MO-0103331 and from the Fulton MS4 through Missouri State Operating Permit MO-R040061.

Where a TMDL is developed for waters impaired by both point and nonpoint sources, point source wasteload allocations must be stringent enough so that in conjunction with the water body's other loadings (i.e., nonpoint sources) water quality standards are met. Reasonable assurance that nonpoint sources will meet their allocated amount is dependent upon the availability and implementation of nonpoint source pollutant reduction plans, controls, or BMPs within the watershed. If BMPs or other nonpoint source pollution controls allow for more stringent load allocations, then wasteload allocations can be less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs (40 CFR 130.2(i)). When a demonstration of nonpoint source reasonable assurance is developed for an impaired water body, additional pollutant allocations for point sources may be allowed provided water quality standards are still attained. If a demonstration of nonpoint source reasonable assurance does not exist, or it is determined that nonpoint source pollutant reduction plans, controls, or BMPs are not feasible, durable, or will not result in the required load reductions, then allocation of greater pollutant loading to point sources cannot occur. This TMDL assumes discharge from the Fulton Wastewater Treatment Facility is the primary

source of flow in Stinson Creek during critical low-flow conditions. Therefore, this TMDL does not include wasteload allocations that are less stringent than the water quality targets determined to attain water quality standards.

A variety of grants and loans may be available to assist watershed stakeholders with developing and implementing watershed based plans, controls, and practices to meet the required wasteload and load allocations in the TMDL and demonstrate reasonable assurance. Additionally, cost-share opportunities for implementation of agricultural BMPs are also available. Examples of nonpoint source reduction practices implemented in the Stinson Creek watershed between 2016 and 2019 are presented in Table 23. These practices reduce both sediment and nutrient transport into streams by reducing overland runoff and erosion.

Additional information regarding potential funding sources, cost-share opportunities, and implementation actions addressing pollutant sources in the Stinson Creek watershed is provided in the supplemental TMDL Implementation Strategies document available online at dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/tmdls.

Table 23. Nonpoint Source Reduction Practices Implemented in the Stinson Creek HUC-12

Year	Practice	Sediment and Nutrient Reduction Area (Acres)
2016	Sediment Retention, Erosion or Water Control Structure	22
2017	Cover Crop	363
2019	Cover Crop	161
	Total	546

15. Public Participation

EPA regulations at 40 CFR130.7 require that TMDLs be subject to public review. An initial 45-day public notice period was held for this revised TMDL from October 18 through December 2, 2019. All comments received during this public comment were considered in finalization of the TMDL. The TMDL was subsequently submitted to EPA Region 7 on January 30, 2020. Following modeling adjustments in response to post-submittal comments provided by EPA, the Department scheduled a second public notice period for this TMDL from July 6 through August 20, 2021. This period was extended an additional 45 days to October 5, 2021 due to a request from the City of Fulton. The Department will make all comments received during these public notice periods and the Department's responses to those comments available online. Groups that directly received notice of the public comment period for this TMDL include, but are not limited to:

- Missouri Clean Water Commission;
- Missouri Water Protection Forum;
- Missouri Department of Conservation;
- County soil and water conservation district;
- Callaway County commission;
- Mid-Missouri Regional Planning Commission;
- University of Missouri Extension;
- Missouri Coalition for the Environment;

- Stream Teams United;
- Stream Team volunteers living in or near the watershed;
- Affected permitted entities; and
- Missouri state legislators representing areas within the watershed.

In addition to those groups contacted directly about the public notice, the Department posted this TMDL and an implementation strategies document online at dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily-loads/tmdls.

The Department also maintains an email distribution list for notifying subscribers of significant TMDL updates or activities, including public notices and comment periods. Those interested in subscribing to TMDL updates can submit their email address using the online form available at public.govdelivery.com/accounts/MODNR/subscriber/new?topic_id=MODNR_177.

16. Administrative Record and Supporting Documentation

The Department has an administrative record on file for the revised Stinson Creek TMDL. The record contains plans, studies, data, and calculations on which the TMDL is based. It additionally includes the public notice announcement, any public comments received, the Department's responses to those comments and files associated with the development of this revised TMDL and the original 2010 TMDL. This information is available upon request to the Department at dnr.mo.gov/open-records-sunshine-law-requests. The Department will process any request for information about this TMDL in accordance with Missouri's Sunshine Law (Chapter 610, RSMO) and the Department's administrative policies and procedures governing Sunshine Law requests.

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Appendix A
Support for QUAL2K Model Assumptions

2010 Approved TMDL QUAL2K Model

A review of the QUAL2K model used for development of the 2010 TMDL revealed several issues resulting in the need for revision. For instance, as displayed in Figure A-1, which is Figure 4 in the 2010 TMDL for Stinson Creek, Reach 1 (the Headwater) spanned for 4.12 km (2.56 miles) from U.S. Highway 54 downstream to Highway O. Reach 2 extended for 1.19 km (0.74 mile) from Highway O to the Fulton Wastewater Treatment Facility. Reach 3 extended from the Fulton Wastewater Treatment Facility for 0.16 km (0.10 mile) downstream. QUAL2K estimates the effects of point source sewage effluent on receiving stream dissolved oxygen, nitrogen, and phosphorus concentrations using numeric inputs for the Headwater and Point Sources (which may also include incoming tributaries). The presence of a long reach of Stinson Creek miles upstream of the Fulton Wastewater Treatment Facility (WWTF) means that the "Headwater" inputs reflect water quality a great distance upstream of the facility (which in this case, no continuous surface flow was observed between ST-1 to ST-2, see Section 5). The designation of reaches in this way likely causes QUAL2K to inaccurately predict the effects of the point source sewage effluent on the impaired segment of Stinson Creek. The model would not estimate the change in water quality as the difference between that immediately upstream and immediately downstream of the facility. Such predictions are the primary purpose of using a QUAL2K model to establish appropriate wasteload allocations. To address these issues, this revised TMDL shortens the Headwater reach to terminate approximately 0.1 km upstream of the point source facility. Reach 2 then spans the length from the terminus of the Headwater reach to a short distance downstream of the facility. This ensures that the point source is located within one continuous reach immediately downstream of the Headwater and allows QUAL2K to appropriately predict the effects of wastewater effluent on Stinson Creek.

Further examination of the original 2010 QUAL2K model revealed that the data used do not reflect a critical low dissolved oxygen condition. None of the dissolved oxygen values presented in Tables 5 and 6 of the original 2010 TMDL are less than 5.0 mg/L. Data were collected in late morning and early afternoon, so failed to capture the early morning low dissolved oxygen concentrations. In addition, data used for calibration were collected in May, when average flow was 2.0 cubic feet per second (cfs), and in September, when average flow was 9.0 cfs. Neither sample date captures water quality when flows in Stinson Creek are at or near the estimated 7Q10 value of 0.01766 cfs. For this revised TMDL, more appropriate data that are representative of impaired stream conditions was used and is described later in more detail.

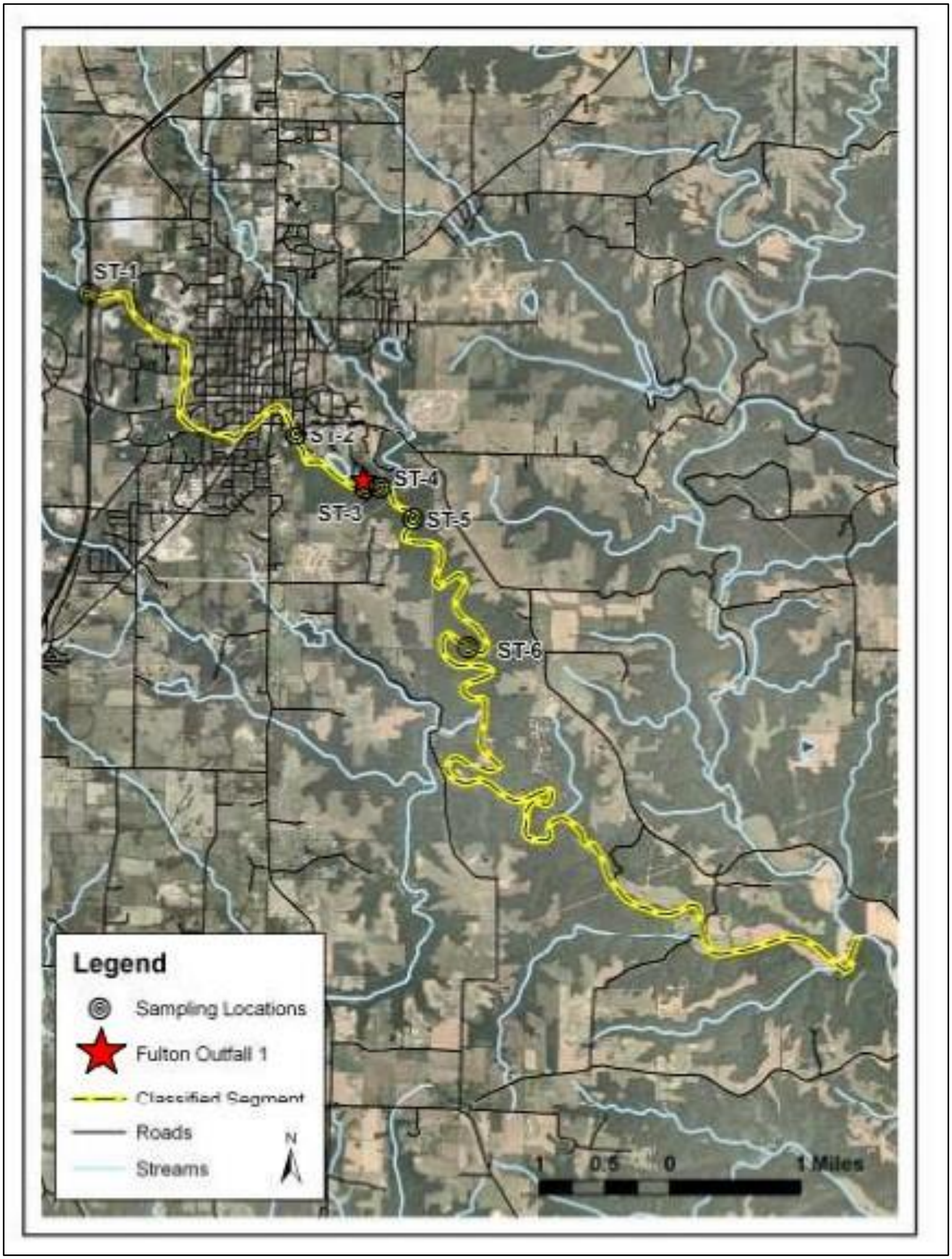

Figure A-1. Locations of Sample Points and Model Reaches in Original 2010 TMDL

Existing Condition of Stinson Creek

Since the development of the 2010 TMDL, the Fulton WWTF has implemented various improvements including: eliminating untreated bypasses, upgrading mechanical treatment, ammonia removal, additional clarification, and an excess holding basin that allows the facility to handle peak flows of up to 7.63 MGD. The facility improvements have resulted in improvements to water quality that have been observed qualitatively through the elimination of algae coverage, discoloration, and offensive odors in Stinson Creek downstream of the facility. Department staff did visual inspections along Stinson Creek on July 9, 2019. At the time of the field visit, water in the creek was clear and the streambed contained gravel and cobble substrate indicative of good quality warm water habitat. Timing of facility upgrades (2017), drought in 2018, and flooding in 2019 have prevented an accurate quantitative assessment of water quality in Stinson Creek since the improvements were completed. Although the revised QUAL2K calibration model only includes a 2.5 km segment of Stinson Creek, as described in Section 5, available water quality data from monitoring locations near the confluence with Youngs Creek (Site ID 710/7.3) and 4.4 miles downstream on Stinson Creek (Site ID 710/2.9) showed dissolved oxygen concentrations are greater than 5.0 mg/L and attaining water quality standards at those locations.

2021 Revised QUAL2K Calibration Model

Reaches

Reaches were established in the 2021 QUAL2K models as displayed on Figure A-2.

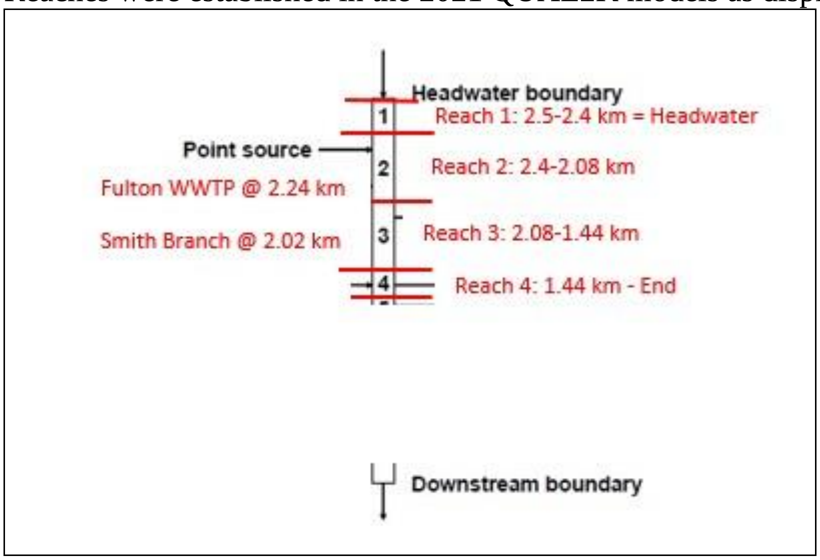

Figure A-2. Stinson Creek QUAL2K Reaches

Calibration Data

The Revised QUAL2K model was calibrated to Department data recorded on August 8, 2002. The 2002 records are the most recent data where morning low dissolved oxygen concentrations were recorded in addition to afternoon data. These data are summarized in Table A-1.

Table A-1. Data Used for the 2021 Revised QUAL2K Calibration Model

Sample Point	Time	Temp °C	DO mg/L	$CBOD_5$ mg/L	Ammonia mg/L	TKN mg/L	Nitrate mg/L	TN mg/L	TP mg/L	pH
1	7:32	18	4.0	<2.0	<0.05	1.16	0.05	1.21	<0.05	7.5
1	13:53	26	4.0	<2.0	<0.05	0.94	<0.05	0.96	<0.05	8.2
Outfall	7:30	24	6.1	<2.0	<0.05	<0.2	24.5	24.6	5.33	7.8
Outfall	13:46	25	7.1	<2.0	<0.05	<0.2	24.8	24.9	5.35	8.0
2	7:22	22	4.3	<2.0	<0.05	0.94	23.5	24.4	5.33	7.9
2	13:32	26	7.2	<2.0	<0.05	<0.2	24.6	24.7	5.12	8.2
3	6:57	20	3.9	<2.0	<0.05	No Data	23.4	No Data	5.84	7.9
3	13:10	25	12.9	<2.0	<0.05	<0.2	22.9	23.0	4.76	8.4

Ultimate CBOD Data and Conversions

Five-day carbonaceous oxygen demand ($CBOD_5$) was evaluated in Stinson Creek on the modeled date (8/8/2002). Lab analyses returned values of <2.0 mg/L "non-detect" for all samples. Facility five-day total oxygen demand (BOD_5) reported in July and August 2002 averaged 4.5 mg/L. However, EPA required that inputs used for the Fulton WWTF be based on a BOD_5 value of 3.0 mg/L. Ultimate carbonaceous oxygen demand (CBODult) for the Fulton WWTF was calculated as follows using EPA's BOD_5 value and a k-value of 0.1 at time (t) of 5 days:

$BOD_5 = 3.0$ mg/L

$CBOD_5 = 3.0/1.33 = 2.26$ mg/L

$CBODult = CBOD_5/(1\text{-}e^{(-kt)})$

$CBODult = 2.26/(1\text{-}e^{(-0.5)}) = 5.74$ mg/L

Calibration Model Inputs

Calibration model Headwater input values and data sources are presented in Table A-2. Calibration model Point Source inputs for the Fulton WWTF and Smith Branch are presented in Tables A-3 and A-4. The resulting calibration graphs for dissolved oxygen, ammonia nitrogen (NH4), total kjeldahl nitrogen (TKN), and organic phosphorus are presented in Figures A-2 through A-5.

Table A-2. Calibration Model Headwater Inputs

Field	Value	Source
Flow Rate	0.0006 cubic meters per second	0.02 cubic feet per second at SP-1
Temperature	18.0°C am/26.0°C pm	SP-1
Conductivity	916.0 umhos am/ 635.0 umhos pm	SP-1
Dissolved Oxygen	4.0 mg/L	SP-1
Fast CBOD ultimate	2.78 mgO_2/L	SP-1 $CBOD_5$=1.4 mgO_2/L (<2.0 mgO_2/L)
Organic Nitrogen	1.135 mg/L am/ 0.915 mg/L pm	SP-1 TKN minus NH4
NH4-Nitrogen	0.025 mg/L	SP-1 (<0.05 mg/L)
NO3-Nitrogen	0.050 mg/L am/0.025 mg/L pm	SP-1 am value/pm (<0.050 mg/L)
Organic Phosphorus	0.02325 mg/L (93%)	SP-1 TP=0.025 mg/L (<0.050 mg/L)
Inorganic Phosphorus	0.00175 mg/L (7%)	
Phytoplankton	3.40 µg/L am/ 6.75 µg/L pm	Median values from six reference streams (see Table A-9) (Morning value 1/2)

Field	Value	Source
Alkalinity	151.0 $mgCaCO_3/L$	Median of Current River Means (USGS 1978)[21]
pH	7.50 and 8.20	SP-1 at 7:32 am and 1:53 pm

Table A-3. Calibration Model Fulton WWTF Inputs

Field	Value	Source
Flow Rate	0.0420 cubic meters per second	1.5 cubic feet per second at Fulton Outfall
Temperature	24.6°C (+/- 1.5°C)	Average at Fulton Outfall
Dissolved Oxygen	6.6 mg/L (+/- 0.5 mg/L)	Average at Fulton Outfall
Fast CBOD ultimate	5.74 mg/L	See Ultimate CBOD Data and Conversions
Organic Nitrogen	0.075 mg/L	Fulton Outfall TKN <0.200 mg/L minus NH4
NH4 Nitrogen	0.025 mg/L	Fulton Outfall (<0.050 mg/L)
NO3 Nitrogen	24.65 mg/L (+/-1.5°C)	Average at Fulton Outfall
Organic Phosphorus	4.966 mg/L (93%)	Fulton Outfall Average TP=5.340 mg/L
Inorganic Phosphorus	3.74 mg/L (7%)	
Phytoplankton	9.0 µg/L	Resulted in calibration to reference point at SP-2 established based on Table A-9
Alkalinity	100.0 $mgCaCO_3/L$	Model default value
pH	7.9 (+/- 0.1)	Average at Fulton Outfall

Table A-4. Calibration Model Smith Branch Inputs

Field	Value	Source
Flow Rate	0.00006 cubic meters per second	0.00221 cubic feet per second USGS StreamStats 7Q10 at confluence of Smith Branch and Stinson Creek
Temperature	22.0°C (+/- 4.0°C)	Average at SP-1 (Headwater)
Dissolved Oxygen	5.0 mg/L (+/- 1.0 mg/L)	+/- Missouri WQS
Fast CBOD ultimate	2.78 mgO_2/L	SP-1 (Headwater) $CBOD_5$=1.4 mgO_2/L (<2.0 mgO_2/L)
Organic Nitrogen	1.025 mg/L	Average TKN at SP-1 (Headwater) minus NH4
NH4 Nitrogen	0.025 mg/L	SP-1 (Headwater) (<0.05 mg/L)
Nitrate+Nitrite	0.025 mg/L	SP-1 (Headwater) (<0.050 mg/L)
Organic Phosphorus	0.02325 mg/L (93%)	SP-1 (Headwater) TP=0.025 mg/L (<0.050 mg/L)
Inorganic Phosphorus	0.00175 mg/L (7%)	
Phytoplankton	5.08 µg/L (+/- 1.7 mg/L)	Average of Headwater value
Alkalinity	151.0 $mgCaCO_3/L$	Median of Current River Means (USGS 1978)[16]
pH	8.20	SP-1 (Headwater)

[21] Barks, James H. 1978. Water Quality in the Ozark National Scenic Riverways, Missouri. Geological Survey Water-Supply Paper 2048. Prepared in cooperation with the National Park Service, U.S. Department of Interior. https://pubs.usgs.gov/wsp/2048/report.pdf

Table A-5. Minimum DO Reach Outputs from Calibration Model

Reach	Sample Points	Minimum DO mg/L Output in Reach
1	Headwater to SP-1	4.00
2	SP-1 to SP-2	3.54
3	SP-2 to SP-3	3.05
4	SP-3 to End	4.42

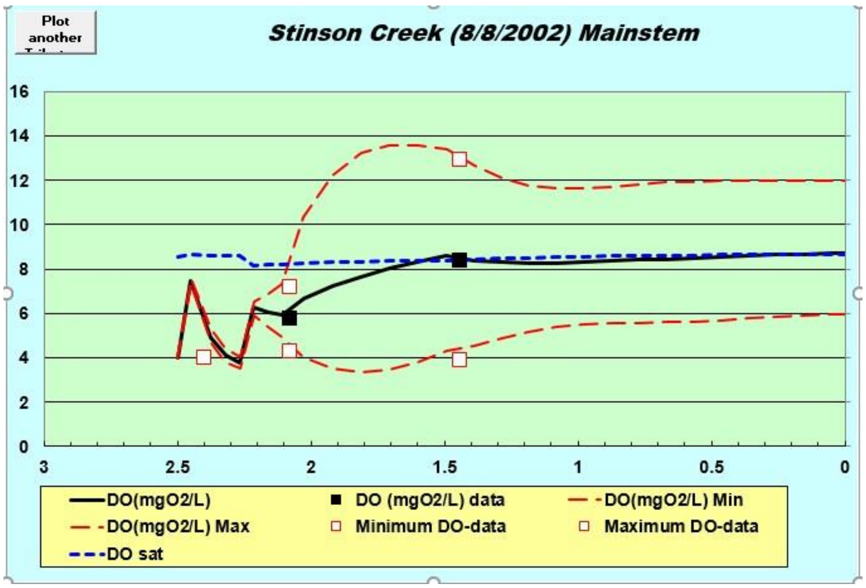

Figure A-2. Calibration Model – Dissolved Oxygen

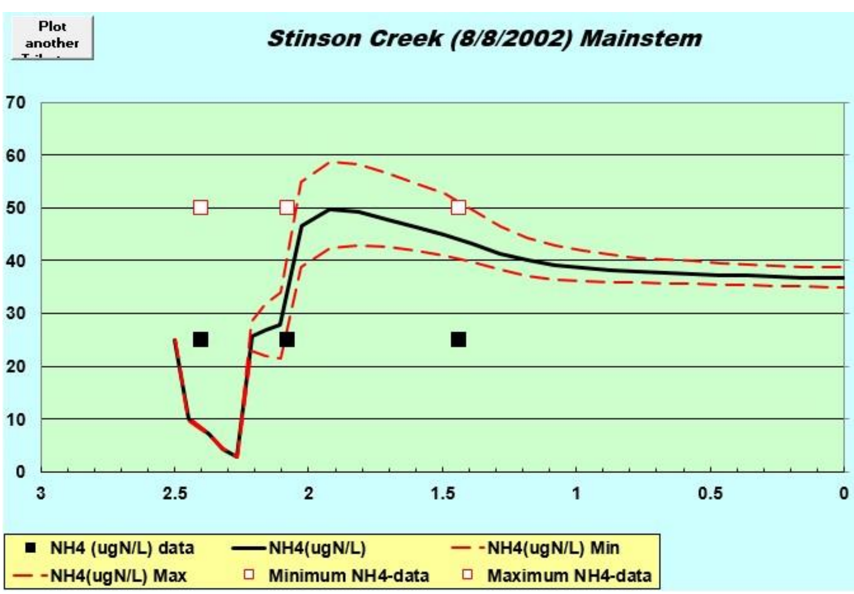

Figure A-3. Calibration Model Ammonia N (NH4)

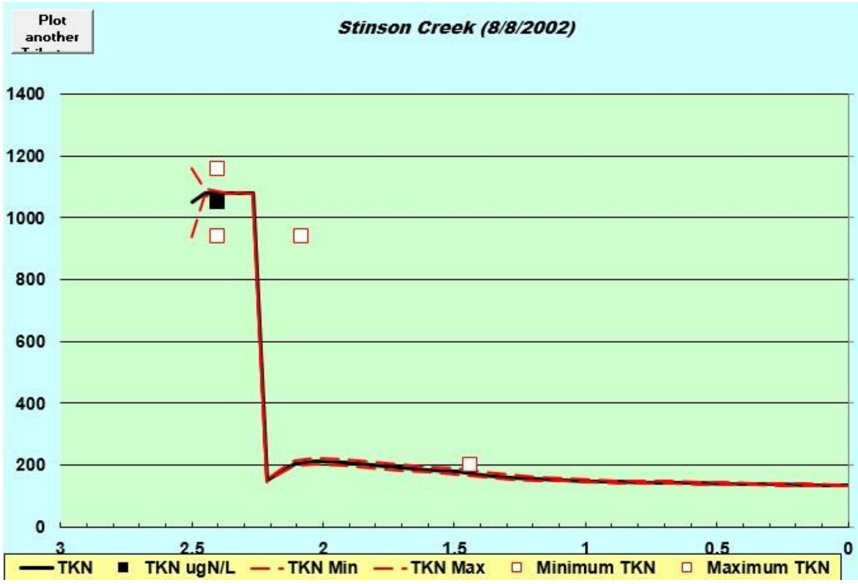

Figure A-4. Calibration Model – TKN

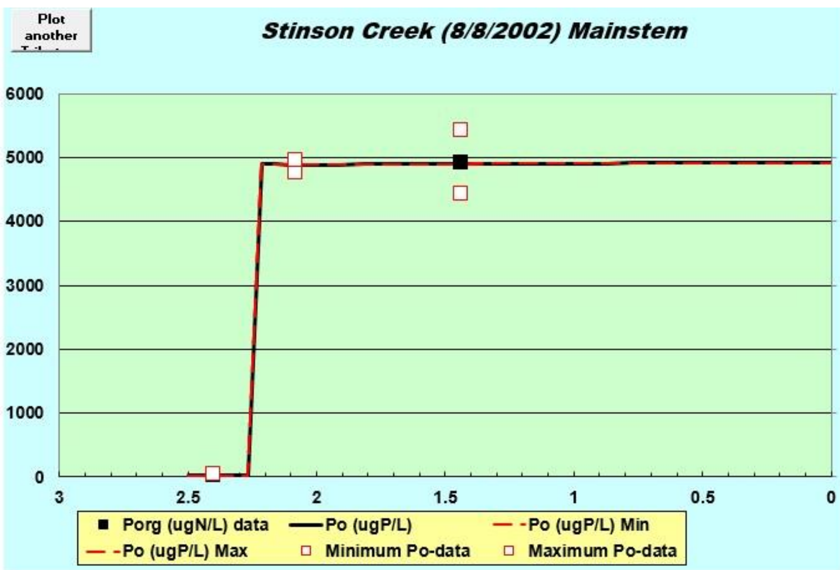

Figure A-5. QUAL2K Calibration Model – Organic Phosphorus

2021 TMDL Wasteload Allocation Model Under Low Flow (7Q10) Condition

The rates and formulas assigned to calibrate the calibration model were retained for the wasteload allocation model. USGS Stream Stats 7Q10 low flow values were used to represent the Headwater and Smith Branch flows. The 2.93 MGD design capacity was used for the Fulton Wastewater Treatment Facility flow. EPA Level III Ecoregion 40 criteria for natural streams were used as the nitrogen and phosphorus inputs for the Headwater and Smith Branch. The wasteload allocation (WLA) for the Fulton MS4 and the load allocation (LA) for nonpoint sources were estimated using the EPA Level III Ecoregion 40 criteria as described in Sections 9.4 and 10. Specific values input into the wasteload allocation model are presented in Tables A-6 through A-8. Fast CBOD ultimate, nitrogen, and phosphorus input values for the Fulton WWTF were adjusted to derive the final values in Table A-7. The model demonstrates that the resulting values will result in DO greater than 5.0 mg/L downstream of the Fulton WWTF.

The low-flow WLA model allows CBODult = 5.0 mg/L at the Fulton WWTF outfall to maintain dissolved oxygen greater than 5.0 mg/L in Stinson Creek. The CBODult was converted to $CBOD_5$ using the equation $CBODult = CBOD_5/(1-e^{-k})$ where k=0.7. Because $CBOD_5$ (not BOD_5) is monitored at the Fulton WWTF outfall for permitting purposes, the final WLA is $CBOD_5$ =2.5 mg/L.

Table A-6. Input Values for Headwater in the Wasteload Allocation Model

Field	Value	Source
Headwater - Flow Rate	0.0005 cubic meters per second	0.0176 cubic feet per second USGS StreamStats 7Q10 at Fulton Outfall
Temperature	18.0°C am/26.0°C pm	Same as calibration model
Dissolved Oxygen	5.0 mg/L	Missouri WQS criterion
Fast CBOD ultimate	2.78 mgO_2/L	Same as calibration model
Organic Nitrogen	0.805 mg/L	EPA Level III Ecoregion 40 criteria TN=0.855 mg/L (2002 Data show Organic N is majority)
NH4-Nitrogen	0.025 mg/L	
NO3-Nitrogen	0.025 mg/L	
Organic Phosphorus	0.0856 mg/L (93%)	EPA Level III Ecoregion 40 criteria TP=0.092 mg/L
Inorganic Phosphorus	0.0064 mg/L (7%)	
Phytoplankton	3.40 µg/L am/ 6.75 µg/L pm	Same as calibration model
Alkalinity	151 $mgCaCO_3/L$	Same as calibration model
pH	7.5 am/8.2 pm	Same as calibration model

Table A-7. Input Values for Fulton WWTF in the Wasteload Allocation Model

Field	Value	Source
Fulton WWTF - Flow Rate	0.1284 cubic meters per second	Facility Design Flow 2.93 MGD
Temperature	24.6°C (+/- 1.5°C)	Same as calibration model
Dissolved Oxygen	7.5 mg/L	Minimum value that will result in stream DO less than or equal to 5.0 mg/L
Fast CBOD ultimate	4.65 mg/L	Maximum value that will result in stream DO less than or equal to 5.0 mg/L
Ammonia Nitrogen	0.7 mg/L	Maximum value that will result in stream DO less than or equal to 5.0 mg/L
Nitrate + Nitrite	9.3 mg/L	Results in TN = 10 mg/L
Organic Phosphorus	0.465 mg/L	Enhanced Nutrient Removal Range TP = 0.5 mg/L
Inorganic Phosphorus	0.035 mg/L	
Phytoplankton	9.0 µg/L	Same as calibration model
Alkalinity	100 $mgCaCO_3/L$	Model default value
pH	7.9 (+/- 0.1)	Same as calibration model

Table A-8. Input Values for Smith Branch in the Wasteload Allocation Model

Field	Value	Source
Smith Branch - Flow Rate	0.00006 cubic meters per second	USGS StreamStats 7Q10 for Smith Branch
Temperature	18.0°C am/26.0°C pm	Same as Headwater
Dissolved Oxygen	5.0 mg/L	Same as Headwater
Fast CBOD ultimate	2.78 mgO_2/L	Same as Headwater
Organic Nitrogen	0.805 mg/L	EPA Level III Ecoregion 40 criteria TN=0.855 mg/L (2002 Data show Organic N is majority)
NH4-Nitrogen	0.025 mg/L	
NO3-Nitrogen	0.025 mg/L	
Organic Phosphorus	0.0856 mg/L (93%)	EPA Level III Ecoregion 40 criteria

Field	Value	Source
Inorganic Phosphorus	0.0064 mg/L (7%)	TP=0.092 mg/L
Phytoplankton	3.40 µg/L am/ 6.75 µg/L pm	Same as Headwater
Alkalinity	151 $mgCaCO_3/L$	Same as Headwater
pH	7.5 am/8.2 pm	Same as Headwater

The fast CBOD ultimate WLA model input of 4.65 mg/L translates to $CBOD_5$ and BOD_5 as follows:

$4.65 = CBOD_5/(1-e^{(-0.5)})$
$CBOD_5 = 1.83$ mg/L
$BOD_5 = 1.83 \times 1.33 = 2.43$

As mentioned previously, a wasteload allocation is assigned to the Fulton MS4, which is located upstream of the Fulton WWTF, and also drains to Smith Branch. Most of the calibration model inputs were retained in the WLA model for the Headwater and Smith Branch. Nitrogen and phosphorus inputs in the WLA model are consistent with EPA Level III Ecoregion 40 criteria, and those values were used to calculate the WLA for the Fulton MS4 and the LA for remaining point source areas. Allocations to the Fulton MS4 and nonpoint sources require reductions in nitrogen and phosphorus loading to Stinson Creek that will reduce benthic algae cover and sediment oxygen demand (SOD). Percent cover by benthic algae and percent SOD were reduced in the WLA model as follows:

- Reach 2 – Receives effluent from the Fulton WWTF
    - TP concentrations for the Fulton WWTF were reduced by 90 percent compared to those observed in 2002. Benthic algae percent cover in the WLA model was reduced by 80 percent (assumes 10 percent TP retained in sediment).
    - The CBODult concentration for the Fulton WWTF was reduced by 19 percent compared to that observed in 2002. SOD percent cover in the WLA model was reduced by 43 percent because reductions in CBODult should correlate with reductions of SOD in stream sediments.
- Reach 3 – Receives water from the Fulton MS4 via Smith Branch
    - Based on calibration model inputs for the Headwater, TP concentrations for the Fulton MS4 were reduced by 88 percent using the EPA Level III Ecoregion 40 criteria. Benthic algae percent cover in the WLA model was reduced by 78 percent (assumes 10 percent TP retained in sediment).
    - Based on calibration model inputs for the Headwater, TN concentrations for the Fulton MS4 were reduced by 96 percent using the EPA Level III Ecoregion 40 criteria. SOD percent cover in the WLA model was reduced by 96 percent because reductions in organic nitrogen loading should correlate with reductions of SOD in stream sediments. The 2002 data show the majority of TN is organic nitrogen.

- Reach 4 – Receives water from nonpoint sources.
    - Based on calibration model inputs for the Headwater, TP concentrations for nonpoint sources were reduced by 88 percent using the EPA Level III Ecoregion 40 criteria. Benthic algae percent cover in the WLA model was reduced by 78 percent (assumes 10 percent TP retained in sediment).
    - Based on calibration model inputs for the Headwater, TN concentrations for nonpoint sources were reduced by 96 percent using the EPA Level III Ecoregion 40 criteria. SOD percent cover in the WLA model was reduced by 96 percent because reductions in organic nitrogen loading should correlate with reductions of SOD in stream sediments.

Based on the model inputs presented in the previous sections, the QUAL2K model predicts that dissolved oxygen concentrations will be a minimum of 5.04 mg/L downstream of the Fulton WWTF. The graphical QUAL2K wasteload allocation model output for dissolved oxygen is displayed in Figure A-6. The minimum DO outputs from QUAL2K are presented in Table A-9.

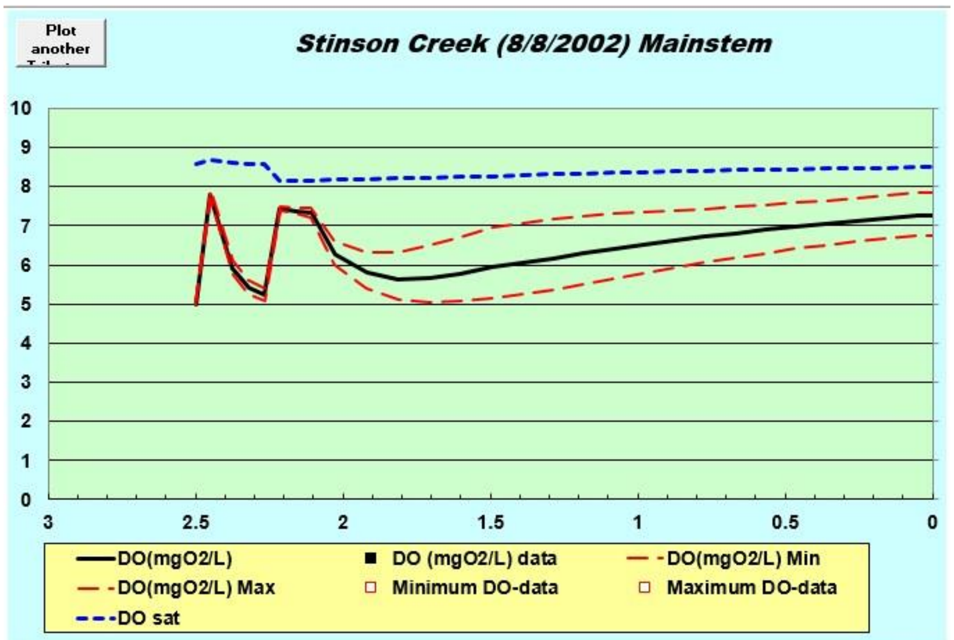

Figure A-6. QUAL2K Wasteload Allocation Model – Dissolved Oxygen

Table A-9. Minimum DO QUAL2K Outputs for the Wasteload Allocation Model

Reach	Distance (km)	Minimum DO(mgO2/L)
Mainstem Headwater Input	2.50	5.00
Owens-Gibbs Reaeration Model Result	2.45	7.67
SP-1 to SP-2	2.37	5.75
SP-1 to SP-2	2.32	5.24
SP-1 to SP-2	2.27	5.07
SP-1 to SP-2	2.21	7.39
SP-1 to SP-2	2.16	7.30

Reach	Distance (km)	Minimum DO(mgO2/L)
SP-1 to SP-2	2.11	7.22
SP-2 to SP-3	2.03	5.99
SP-2 to SP-3	1.92	5.38
SP-2 to SP-3	1.81	5.11
SP-2 to SP-3	1.71	5.03
SP-2 to SP-3	1.60	5.06
SP-2 to SP-3	1.49	5.16
SP-3 to End	1.39	5.26
SP-3 to End	1.29	5.37
SP-3 to End	1.18	5.50
SP-3 to End	1.08	5.64
SP-3 to End	0.98	5.78
SP-3 to End	0.87	5.92
SP-3 to End	0.77	6.05
SP-3 to End	0.67	6.18
SP-3 to End	0.57	6.30
SP-3 to End	0.46	6.41
SP-3 to End	0.36	6.51
SP-3 to End	0.26	6.60
SP-3 to End	0.15	6.68
SP-3 to End	0.05	6.76
Terminus	0.00	6.76

Table A-10. Phytoplankton Data and Derivation of Reference Point for Stinson Creek

Sample Date	Time	WBID	Stream	Mechanical Plant	US Chl-a	Outfall Chl-a	DS1 Chl-a	DS2 Chl-a
8/28/2003	12:30	1870	Spring Creek	Salem	2.7	No Data	3.1	2
7/9/2013	11:55	3822/ 1444	Town Branch/Piper Creek	Bolivar	32.8	43.5	25.6	44.4
8/21/2018	13:00	3822/ 1444	Town Branch/Piper Creek	Bolivar	3.4	1.3	2.6	4.6
8/22/2018	13:00	3822/ 1444	Town Branch/Piper Creek	Bolivar	3.5	2.2	2.9	3.3
8/17/2015		1300	Mound Branch	Butler	17.6	No Data	4.1	2.8
7/30/2019	14:25	2835	St. Francois River	Farmington West	3	5.4	3.7	No Data
7/31/2019	14:30	2835	St. Francois River	Farmington West	4.3	5.1	2.9	No Data
7/10/2018	13:08	189	Elkhorn Creek	Montgomery City East	9.2	9.8	13.6	10.2
7/11/2018	13:00	189	Elkhorn Creek	Montgomery City East	18.6	4	40.4	19.9
8/5/2020	13:10	1325	L. Drywood Creek	Nevada	15.8	6	10.7	17.6
Stinson Creek Estimated				**Median**	**6.75**	**5.25**	**3.9**	**7.4**

Appendix B
Total Suspended Solids Load Duration Curve Development

Overview
The load duration curve approach was used to develop the total suspended solids TMDL for Stinson Creek. The load duration curve method allows for characterizing water quality concentrations at different flow regimes and estimating the load allocations and wasteload allocations for the impaired segment. This method also provides a visual display of the relationship between stream flow and loading capacity. Using the duration curve framework, allowable loadings are easily presented.

Methodology
The load duration curve method requires a long-term time series of daily flows and a numeric water quality target (typically the applicable numeric criterion or a surrogate when addressing general criteria). When available, pollutant data from the impaired segment is used to provide estimates of observed loads (based on flow estimates for the same date) and are plotted along with the load duration curve to assess when the water quality target may have been exceeded. Such information is useful for determining appropriate best management practices to reduce pollutant loading.

The average daily flow data from a gage or multiple gages that are representative of the impaired reach are used to develop a load duration curve. The flow record should be of sufficient length to be able to calculate percentiles of flow. If a flow record for an impaired stream is not available, then flow data collected from a gage in a representative watershed may be used or a synthetic flow record from several gages can be developed. For Stinson Creek, a synthetic flow record was developed using the log discharge per square mile of USGS gages from streams within the same EDU and 8-digit HUC as Stinson Creek. Five gages with sufficient flow records were used to develop a synthetic flow (Table B-1) for this TMDL. Nash-Sutcliffe statistics are calculated for each gage flow record used to develop the synthetic flow in order to determine if the relationship is valid for each record. The Nash-Sutcliffe statistic evaluates the efficiency of a predicted (modeled) flow dataset (Nash and Sutcliffe 1970). An efficiency of 1 (100 percent) describes a perfect match, while values less than zero indicate a poor fit of modeled and observed datasets (USGS 2010). This relationship must be valid in order to use the synthetic flow methodology. Model estimates are considered satisfactory if Nash-Sutcliffe statistics are greater than 50 percent (USGS 2013).

Figure B-1 presents the synthesized flow duration curve developed for the EDU. Figure B-2 is the estimated flow for Stinson Creek based on the area corrected synthesized flow and point source design flow discharges added. The estimated flows for Stinson Creek, in units of cubic feet per second, were multiplied by the concentration target of 5 mg/L and a conversion factor of 5.394 in order to generate the allowable total suspended solids load in units of lbs/day.[22] Table B-2 presents available total suspended solids data from Stinson Creek plotted along the load duration to illustrate conditions when excessive sediment loading may be occurring. The concentration target and the facilities' design flows were used to derive the static wasteload allocation assigned to municipal and domestic wastewater treatment facilities. Wasteload allocations to the Fulton MS4 are based on the proportion of municipal area in the watershed and vary with flow. Selection of the target

[22] $Load\ \left(\frac{\text{lbs}}{\text{day}}\right) = \left[Target\left(\frac{\text{mg}}{\text{100ml}}\right)\right] * \left[Flow\ \left(\frac{feet^3}{s}\right)\right] * [Conversion\ Factor]$

concentration used a reference approach and was derived as the 25th percentile of all total suspended solids data in the EDU and provides an implicit margin of safety (Table B-3). The load allocation assigned to nonpoint sources is calculated as the remainder of the loading capacity after allocations to point sources. Nonpoint sources are not expected to contribute pollutant loading during critical low flow conditions, therefore load allocations to nonpoint sources at these low flows will likely provide an additional margin of safety.

Table B-1. Stream gages used to develop synthetic flow for Stinson Creek[23]

USGS Gage	Drainage Area (mi^2)	Period of Data	Nash-Sutcliff (%)
06910750 Moreau River near Jefferson City, MO	561	2000 – 2019	99
06909500 Moniteau Creek near Fayette, MO	75.1	2002 – 2018	98
06910230 Hinkson Creek at Columbia, MO	69.8	2007 – 2019	67
06909950 Petite Saline Creek at Hwy U near Boonville, MO	136	2007 – 2018	99
06927240 Auxvasse Creek near Reform, MO	292	2008 – 2019	80
		Mean:	**89**

Table B-2. Available Total Suspended Solids data from Stinson Creek (September 17, 2018)

Site Code	Site Name	Total Suspended Solids (mg/L)
710/2.9	Stinson Creek Upstream of County Road 419	<5.0
710/10.9	Stinson Creek 0.2 miles below Fulton WWTF	<5.0
710/11.2	Stinson Creek 0.1 mile above Fulton WWTF	<5.0
710/11.9/0.2	Stinson Creek at State Highway O	5.0
710/12.9	Stinson Creek downstream of Westminster Ave	19.0
710/14.3	Stinson Creek upstream of pedestrian bridge off Wolking Drive	<5.0

[23] Flow data that were in provisional status at the time of this report were not used

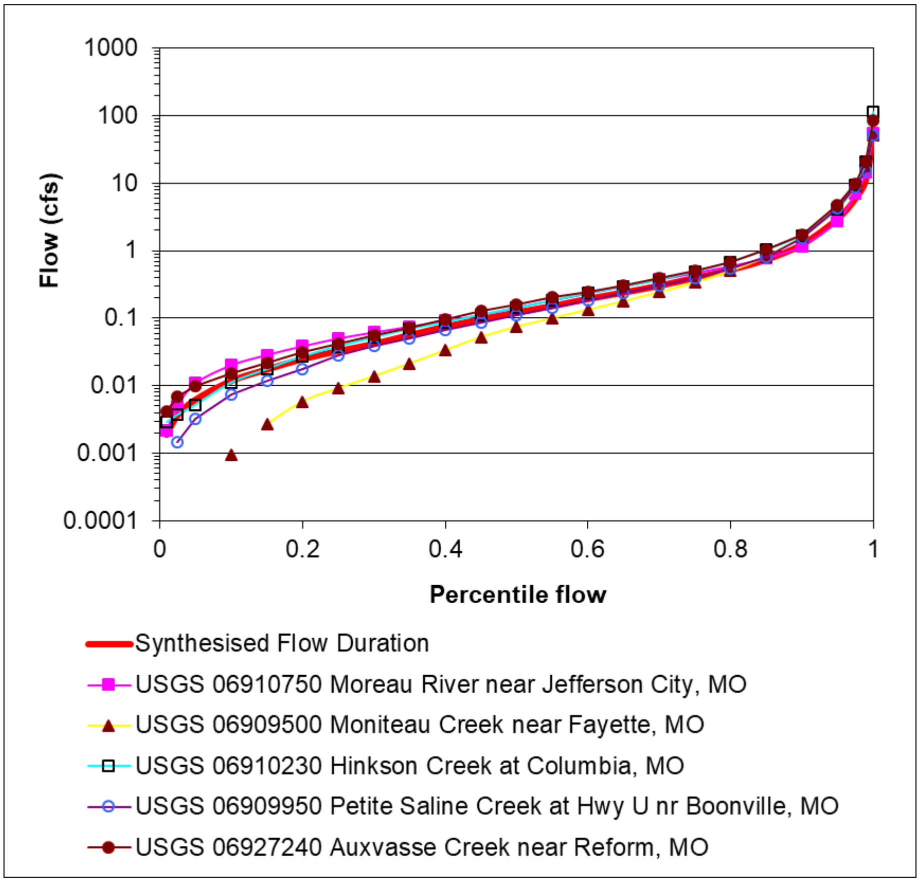

Figure B-1. EDU flow duration curve

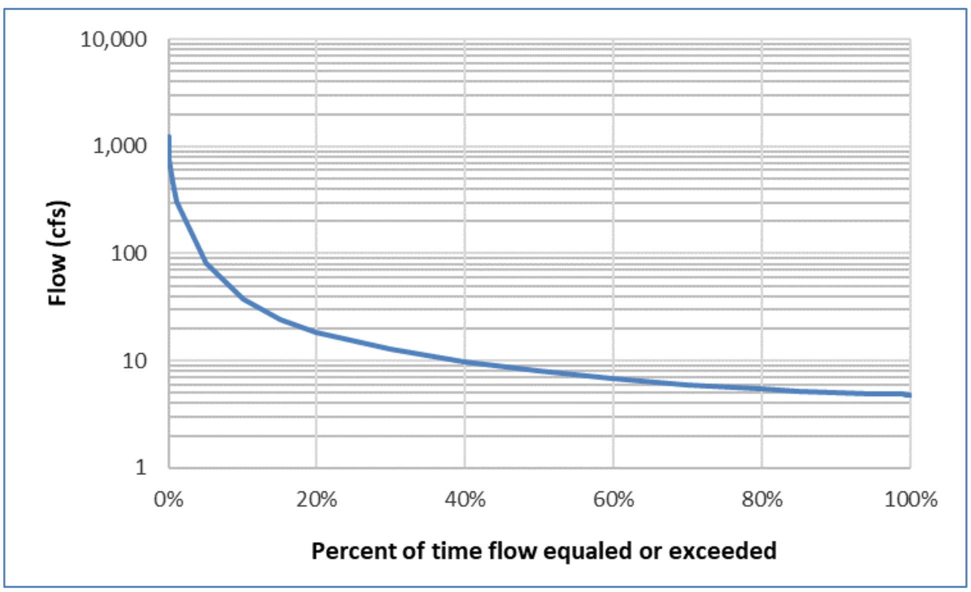

Figure B-2. Stinson Creek flow duration curve

Table B-2. USGS total suspended solids data used to develop TMDL target (sorted by date)[24]

Site Code	Site Name	Date	TSS (mg/L)
2835/36.8	St. Francis R. @Saco	10/22/1982	<1.0
2835/36.8	St. Francis R. @Saco	11/24/1982	<1.0
2835/36.8	St. Francis R. @Saco	12/16/1982	<1.0
2835/36.8	St. Francis R. @Saco	2/16/1983	1.0
2835/36.8	St. Francis R. @Saco	3/24/1983	4.0
2835/36.8	St. Francis R. @Saco	4/13/1983	9.0
2835/36.8	St. Francis R. @Saco	5/25/1983	6.0
2835/36.8	St. Francis R. @Saco	6/21/1983	11.0
2835/36.8	St. Francis R. @Saco	7/5/1983	3.0
2835/36.8	St. Francis R. @Saco	8/3/1983	4.0
2835/36.8	St. Francis R. @Saco	9/1/1983	1.0
2835/36.8	St. Francis R. @Saco	10/4/1983	6.0
2835/36.8	St. Francis R. @Saco	11/9/1983	4.0
2034/21.5	Bourbeuse R. above Union	11/16/1983	20.0
2034/21.5	Bourbeuse R. above Union	12/21/1983	12.0
2835/36.8	St. Francis R. @Saco	1/5/1984	8.0
2034/21.5	Bourbeuse R. above Union	1/18/1984	10.0
2835/36.8	St. Francis R. @Saco	1/26/1984	6.0
2835/36.8	St. Francis R. @Saco	2/17/1984	11.0
2034/21.5	Bourbeuse R. above Union	2/23/1984	21.0
2835/36.8	St. Francis R. @Saco	3/8/1984	5.0
2034/21.5	Bourbeuse R. above Union	3/21/1984	146.0
2835/36.8	St. Francis R. @Saco	4/3/1984	8.0
2034/21.5	Bourbeuse R. above Union	4/19/1984	18.0
2835/36.8	St. Francis R. @Saco	5/1/1984	16.0
2034/21.5	Bourbeuse R. above Union	5/10/1984	18.0
2835/36.8	St. Francis R. @Saco	6/5/1984	7.0
2034/21.5	Bourbeuse R. above Union	6/20/1984	8.0
2835/36.8	St. Francis R. @Saco	7/17/1984	<2.0
2034/21.5	Bourbeuse R. above Union	7/18/1984	13.0
2034/21.5	Bourbeuse R. above Union	8/14/1984	8.0
2835/36.8	St. Francis R. @Saco	8/23/1984	8.0
2835/36.8	St. Francis R. @Saco	9/10/1984	3.0
2034/21.5	Bourbeuse R. above Union	9/18/1984	9.0
2034/21.5	Bourbeuse R. above Union	10/11/1984	3.0
2835/36.8	St. Francis R. @Saco	10/16/1984	7.0
2034/21.5	Bourbeuse R. above Union	11/9/1984	12.0
2835/36.8	St. Francis R. @Saco	11/13/1984	3.0
2034/21.5	Bourbeuse R. above Union	12/6/1984	11.0
2835/36.8	St. Francis R. @Saco	12/17/1984	1.0
2034/21.5	Bourbeuse R. above Union	1/11/1985	16.0
2835/36.8	St. Francis R. @Saco	1/29/1985	4.0
2835/36.8	St. Francis R. @Saco	2/13/1985	5.0
2034/21.5	Bourbeuse R. above Union	2/21/1985	45.0

[24] Where values are recorded as being less than the detection limit, half the detection limit was used for calculation purposes.

2034/21.5	Bourbeuse R. above Union	3/14/1985	65.0
2835/36.8	St. Francis R. @Saco	3/14/1985	12.0
2034/21.5	Bourbeuse R. above Union	4/4/1985	28.0
2835/36.8	St. Francis R. @Saco	4/9/1985	3.0
2034/21.5	Bourbeuse R. above Union	5/10/1985	11.0
2835/36.8	St. Francis R. @Saco	5/14/1985	16.0
2034/21.5	Bourbeuse R. above Union	6/12/1985	158.0
2835/36.8	St. Francis R. @Saco	6/17/1985	22.0
2034/21.5	Bourbeuse R. above Union	7/12/1985	6.0
2835/36.8	St. Francis R. @Saco	7/15/1985	8.0
2034/21.5	Bourbeuse R. above Union	8/7/1985	61.0
2835/36.8	St. Francis R. @Saco	8/12/1985	5.0
2034/21.5	Bourbeuse R. above Union	9/19/1985	5.0
2835/36.8	St. Francis R. @Saco	9/23/1985	3.0
2034/21.5	Bourbeuse R. above Union	10/18/1985	5.0
2835/36.8	St. Francis R. @Saco	10/21/1985	6.0
2034/21.5	Bourbeuse R. above Union	11/22/1985	122.0
2835/36.8	St. Francis R. @Saco	11/22/1985	9.0
2034/21.5	Bourbeuse R. above Union	12/12/1985	426.0
2835/36.8	St. Francis R. @Saco	12/16/1985	7.0
2034/21.5	Bourbeuse R. above Union	1/10/1986	2.0
2835/36.8	St. Francis R. @Saco	1/21/1986	3.0
2034/21.5	Bourbeuse R. above Union	2/13/1986	23.0
2835/36.8	St. Francis R. @Saco	2/13/1986	5.0
2835/36.8	St. Francis R. @Saco	3/3/1986	3.0
2034/21.5	Bourbeuse R. above Union	3/12/1986	49.0
2835/36.8	St. Francis R. @Saco	4/7/1986	6.0
2034/21.5	Bourbeuse R. above Union	4/10/1986	2.0
2835/36.8	St. Francis R. @Saco	5/12/1986	<1.0
2034/21.5	Bourbeuse R. above Union	5/16/1986	8.0
2835/36.8	St. Francis R. @Saco	6/11/1986	38.0
2034/21.5	Bourbeuse R. above Union	6/12/1986	25.0
2034/21.5	Bourbeuse R. above Union	7/11/1986	5.0
2835/36.8	St. Francis R. @Saco	7/14/1986	37.0
2835/36.8	St. Francis R. @Saco	8/13/1986	8.0
2034/21.5	Bourbeuse R. above Union	8/27/1986	6.0
2835/36.8	St. Francis R. @Saco	9/15/1986	5.0
2034/21.5	Bourbeuse R. above Union	9/19/1986	523.0
2835/36.8	St. Francis R. @Saco	10/20/1986	5.0
2034/21.5	Bourbeuse R. above Union	10/23/1986	5.0
2835/36.8	St. Francis R. @Saco	11/14/1986	<1.0
2034/21.5	Bourbeuse R. above Union	11/21/1986	9.0
2835/36.8	St. Francis R. @Saco	12/11/1986	16.0
2034/21.5	Bourbeuse R. above Union	12/18/1986	21.0
2835/36.8	St. Francis R. @Saco	1/6/1987	2.0
2034/21.5	Bourbeuse R. above Union	1/12/1987	0
2835/36.8	St. Francis R. @Saco	2/3/1987	6.0
2034/21.5	Bourbeuse R. above Union	2/5/1987	11.0
2835/36.8	St. Francis R. @Saco	3/2/1987	31.0

2034/21.5	Bourbeuse R. above Union	3/5/1987	29.0
2835/36.8	St. Francis R. @Saco	4/2/1987	<1.0
2034/21.5	Bourbeuse R. above Union	4/9/1987	18.0
2835/36.8	St. Francis R. @Saco	5/5/1987	<1.0
2034/21.5	Bourbeuse R. above Union	5/14/1987	19.0
2835/36.8	St. Francis R. @Saco	6/4/1987	7.0
2034/21.5	Bourbeuse R. above Union	6/9/1987	12.0
2835/36.8	St. Francis R. @Saco	11/10/1988	7.0
2835/36.8	St. Francis R. @Saco	11/15/1988	10.0
2835/36.8	St. Francis R. @Saco	11/20/1988	75.0
2835/36.8	St. Francis R. @Saco	11/25/1988	20.0
2835/36.8	St. Francis R. @Saco	11/30/1988	5.0
2835/36.8	St. Francis R. @Saco	12/5/1988	19.0
2835/36.8	St. Francis R. @Saco	12/10/1988	14.0
2835/36.8	St. Francis R. @Saco	12/15/1988	4.0
2835/36.8	St. Francis R. @Saco	12/15/1988	4.0
2835/36.8	St. Francis R. @Saco	12/20/1988	3.0
2835/36.8	St. Francis R. @Saco	12/25/1988	2.0
2835/36.8	St. Francis R. @Saco	12/31/1988	9.0
2835/36.8	St. Francis R. @Saco	1/5/1989	26.0
2835/36.8	St. Francis R. @Saco	1/10/1989	3.0
2835/36.8	St. Francis R. @Saco	1/13/1989	7.0
2835/36.8	St. Francis R. @Saco	1/15/1989	3.0
2835/36.8	St. Francis R. @Saco	1/20/1989	3.0
2835/36.8	St. Francis R. @Saco	1/25/1989	9.0
2835/36.8	St. Francis R. @Saco	1/31/1989	8.0
2835/36.8	St. Francis R. @Saco	2/5/1989	56.0
2835/36.8	St. Francis R. @Saco	2/8/1989	4.0
2835/36.8	St. Francis R. @Saco	2/10/1989	8.0
2835/36.8	St. Francis R. @Saco	2/15/1989	246.0
2835/36.8	St. Francis R. @Saco	2/20/1989	9.0
2835/36.8	St. Francis R. @Saco	2/25/1989	5.0
2835/36.8	St. Francis R. @Saco	2/28/1989	4.0
2835/36.8	St. Francis R. @Saco	3/5/1989	54.0
2835/36.8	St. Francis R. @Saco	3/9/1989	3.0
2835/36.8	St. Francis R. @Saco	3/10/1989	5.0
2835/36.8	St. Francis R. @Saco	3/15/1989	1.0
2835/36.8	St. Francis R. @Saco	3/20/1989	9.0
2835/36.8	St. Francis R. @Saco	3/25/1989	3.0
2835/36.8	St. Francis R. @Saco	3/31/1989	55.0
2835/36.8	St. Francis R. @Saco	4/5/1989	83.0
2835/36.8	St. Francis R. @Saco	4/10/1989	3.0
2835/36.8	St. Francis R. @Saco	4/14/1989	4.0
2835/36.8	St. Francis R. @Saco	4/15/1989	4.0
2835/36.8	St. Francis R. @Saco	4/20/1989	28.0
2835/36.8	St. Francis R. @Saco	4/25/1989	10.0
2835/36.8	St. Francis R. @Saco	4/30/1989	26.0
2835/36.8	St. Francis R. @Saco	5/5/1989	10.0
2835/36.8	St. Francis R. @Saco	5/10/1989	29.0

2835/36.8	St. Francis R. @Saco	5/15/1989	9.0
2835/36.8	St. Francis R. @Saco	5/17/1989	9.0
2835/36.8	St. Francis R. @Saco	5/20/1989	18.0
2835/36.8	St. Francis R. @Saco	5/25/1989	7.0
2835/36.8	St. Francis R. @Saco	5/31/1989	11.0
2835/36.8	St. Francis R. @Saco	6/5/1989	11.0
2835/36.8	St. Francis R. @Saco	6/6/1989	38.0
2835/36.8	St. Francis R. @Saco	6/10/1989	14.0
2835/36.8	St. Francis R. @Saco	6/15/1989	80.0
2835/36.8	St. Francis R. @Saco	6/20/1989	50.0
2835/36.8	St. Francis R. @Saco	6/25/1989	9.0
2835/36.8	St. Francis R. @Saco	6/30/1989	1.0
2835/36.8	St. Francis R. @Saco	7/5/1989	2.0
2835/36.8	St. Francis R. @Saco	7/10/1989	1.0
2835/36.8	St. Francis R. @Saco	7/15/1989	2.0
2835/36.8	St. Francis R. @Saco	7/20/1989	2.0
2835/36.8	St. Francis R. @Saco	7/25/1989	3.0
2835/36.8	St. Francis R. @Saco	7/31/1989	7.0
2835/36.8	St. Francis R. @Saco	8/5/1989	6.0
2835/36.8	St. Francis R. @Saco	8/10/1989	4.0
2835/36.8	St. Francis R. @Saco	8/15/1989	5.0
2835/36.8	St. Francis R. @Saco	8/20/1989	5.0
2835/36.8	St. Francis R. @Saco	8/25/1989	10.0
2835/36.8	St. Francis R. @Saco	8/31/1989	5.0
2835/36.8	St. Francis R. @Saco	9/5/1989	5.0
2835/36.8	St. Francis R. @Saco	9/10/1989	4.0
2835/36.8	St. Francis R. @Saco	9/15/1989	10.0
2835/36.8	St. Francis R. @Saco	9/20/1989	2.0
2835/36.8	St. Francis R. @Saco	9/25/1989	2.0
2835/36.8	St. Francis R. @Saco	9/30/1989	5.0
2835/36.8	St. Francis R. @Saco	10/5/1989	4.0
2835/36.8	St. Francis R. @Saco	10/10/1989	4.0
737/25.0	Cedar Cr. @I-70	10/11/1989	8.0
2835/36.8	St. Francis R. @Saco	10/20/1989	2.0
2835/36.8	St. Francis R. @Saco	10/25/1989	2.0
2835/36.8	St. Francis R. @Saco	10/31/1989	2.0
2835/36.8	St. Francis R. @Saco	11/5/1989	8.0
737/25.0	Cedar Cr. @I-70	11/9/1989	16.0
2835/36.8	St. Francis R. @Saco	11/10/1989	2.0
2835/36.8	St. Francis R. @Saco	11/20/1989	4.0
2835/36.8	St. Francis R. @Saco	11/25/1989	2.0
2835/36.8	St. Francis R. @Saco	11/30/1989	2.0
2835/36.8	St. Francis R. @Saco	12/5/1989	2.0
737/25.0	Cedar Cr. @I-70	12/5/1989	22.0
737/25.0	Cedar Cr. @I-70	1/19/1990	34.0
2835/36.8	St. Francis R. @Saco	1/20/1990	527.0
2835/36.8	St. Francis R. @Saco	1/25/1990	7.0
737/25.0	Cedar Cr. @I-70	2/14/1990	15.0
2835/36.8	St. Francis R. @Saco	2/15/1990	183.0

2835/36.8	St. Francis R. @Saco	2/20/1990	6.0
2835/36.8	St. Francis R. @Saco	3/15/1990	22.0
2835/36.8	St. Francis R. @Saco	3/20/1990	51.0
737/25.0	Cedar Cr. @I-70	3/21/1990	14.0
2835/36.8	St. Francis R. @Saco	4/5/1990	6.0
2835/36.8	St. Francis R. @Saco	4/10/1990	209.0
737/25.0	Cedar Cr. @I-70	4/11/1990	17.0
2835/36.8	St. Francis R. @Saco	4/20/1990	3.0
2835/36.8	St. Francis R. @Saco	4/25/1990	1.0
2835/36.8	St. Francis R. @Saco	4/30/1990	2.0
737/25.0	Cedar Cr. @I-70	5/9/1990	13.0
2835/36.8	St. Francis R. @Saco	5/10/1990	3.0
2835/36.8	St. Francis R. @Saco	5/15/1990	14.0
2835/36.8	St. Francis R. @Saco	6/5/1990	4.0
737/25.0	Cedar Cr. @I-70	6/5/1990	5.0
2835/36.8	St. Francis R. @Saco	6/25/1990	2.0
737/25.0	Cedar Cr. @I-70	7/11/1990	1860.0
737/25.0	Cedar Cr. @I-70	8/8/1990	46.0
2835/36.8	St. Francis R. @Saco	8/15/1990	4.0
2835/36.8	St. Francis R. @Saco	8/25/1990	15.0
2835/36.8	St. Francis R. @Saco	8/31/1990	5.0
2835/36.8	St. Francis R. @Saco	9/5/1990	7.0
737/25.0	Cedar Cr. @I-70	9/6/1990	8.0
2835/36.8	St. Francis R. @Saco	9/10/1990	5.0
2835/36.8	St. Francis R. @Saco	9/15/1990	7.0
2835/36.8	St. Francis R. @Saco	9/20/1990	4.0
2835/36.8	St. Francis R. @Saco	9/25/1990	2.0
2835/36.8	St. Francis R. @Saco	1/15/1991	7.0
2835/36.8	St. Francis R. @Saco	1/20/1991	6.0
2835/36.8	St. Francis R. @Saco	1/25/1991	9.0
2835/36.8	St. Francis R. @Saco	1/31/1991	7.0
2835/36.8	St. Francis R. @Saco	2/5/1991	8.0
2835/36.8	St. Francis R. @Saco	2/10/1991	8.0
2835/36.8	St. Francis R. @Saco	2/15/1991	7.0
2835/36.8	St. Francis R. @Saco	2/20/1991	3.0
2835/36.8	St. Francis R. @Saco	2/28/1991	1.0
2835/36.8	St. Francis R. @Saco	3/5/1991	11.0
2835/36.8	St. Francis R. @Saco	3/10/1991	3.0
2835/36.8	St. Francis R. @Saco	3/20/1991	3.0
2835/36.8	St. Francis R. @Saco	4/10/1991	17.0
2835/36.8	St. Francis R. @Saco	4/15/1991	80.0
2835/36.8	St. Francis R. @Saco	4/30/1991	29.0
2835/36.8	St. Francis R. @Saco	5/10/1991	3.0
2835/36.8	St. Francis R. @Saco	5/15/1991	10.0
2835/36.8	St. Francis R. @Saco	5/20/1991	5.0
2835/36.8	St. Francis R. @Saco	5/25/1991	4.0
2835/36.8	St. Francis R. @Saco	5/31/1991	3.0
2835/36.8	St. Francis R. @Saco	6/5/1991	8.0
2835/36.8	St. Francis R. @Saco	6/10/1991	5.0

2835/36.8	St. Francis R. @Saco	6/15/1991	6.0
2835/36.8	St. Francis R. @Saco	6/20/1991	4.0
2835/36.8	St. Francis R. @Saco	6/25/1991	6.0
2835/36.8	St. Francis R. @Saco	6/30/1991	4.0
2835/36.8	St. Francis R. @Saco	7/5/1991	12.0
2835/36.8	St. Francis R. @Saco	7/10/1991	12.0
2835/36.8	St. Francis R. @Saco	7/15/1991	11.0
2835/36.8	St. Francis R. @Saco	7/20/1991	6.0
2835/36.8	St. Francis R. @Saco	7/25/1991	8.0
2835/36.8	St. Francis R. @Saco	7/31/1991	4.0
2835/36.8	St. Francis R. @Saco	8/5/1991	3.0
2835/36.8	St. Francis R. @Saco	8/10/1991	6.0
2835/36.8	St. Francis R. @Saco	8/15/1991	5.0
2835/36.8	St. Francis R. @Saco	8/20/1991	5.0
2835/36.8	St. Francis R. @Saco	9/10/1991	7.0
2835/36.8	St. Francis R. @Saco	9/15/1991	6.0
2835/36.8	St. Francis R. @Saco	10/5/1991	47.0
2835/36.8	St. Francis R. @Saco	10/10/1991	36.0
2835/36.8	St. Francis R. @Saco	10/15/1991	31.0
2835/36.8	St. Francis R. @Saco	10/20/1991	33.0
2835/36.8	St. Francis R. @Saco	10/25/1991	40.0
2835/36.8	St. Francis R. @Saco	10/31/1991	41.0
2835/36.8	St. Francis R. @Saco	11/5/1991	42.0
2835/36.8	St. Francis R. @Saco	11/10/1991	40.0
2835/36.8	St. Francis R. @Saco	11/15/1991	15.0
2835/36.8	St. Francis R. @Saco	11/20/1991	163.0
2835/36.8	St. Francis R. @Saco	11/25/1991	27.0
2835/36.8	St. Francis R. @Saco	11/30/1991	126.0
2835/36.8	St. Francis R. @Saco	12/5/1991	9.0
2835/36.8	St. Francis R. @Saco	12/10/1991	5.0
2835/36.8	St. Francis R. @Saco	12/15/1991	2.0
2835/36.8	St. Francis R. @Saco	12/20/1991	2.0
2835/36.8	St. Francis R. @Saco	12/25/1991	2.0
2835/36.8	St. Francis R. @Saco	12/31/1991	3.0
2835/36.8	St. Francis R. @Saco	1/5/1992	6.0
2835/36.8	St. Francis R. @Saco	1/10/1992	16.0
2835/36.8	St. Francis R. @Saco	1/15/1992	16.0
2835/36.8	St. Francis R. @Saco	1/20/1992	10.0
2835/36.8	St. Francis R. @Saco	1/25/1992	5.0
2835/36.8	St. Francis R. @Saco	1/31/1992	6.0
2835/36.8	St. Francis R. @Saco	2/5/1992	4.0
2835/36.8	St. Francis R. @Saco	2/10/1992	8.0
2835/36.8	St. Francis R. @Saco	2/15/1992	87.0
2835/36.8	St. Francis R. @Saco	2/20/1992	38.0
2835/36.8	St. Francis R. @Saco	2/25/1992	7.0
2835/36.8	St. Francis R. @Saco	2/29/1992	2.0
2835/36.8	St. Francis R. @Saco	3/5/1992	15.0
2835/36.8	St. Francis R. @Saco	3/10/1992	16.0
2835/36.8	St. Francis R. @Saco	3/15/1992	12.0

2835/36.8	St. Francis R. @Saco	3/20/1992	284.0
2835/36.8	St. Francis R. @Saco	3/25/1992	19.0
2835/36.8	St. Francis R. @Saco	3/31/1992	119.0
2835/36.8	St. Francis R. @Saco	4/5/1992	15.0
2835/36.8	St. Francis R. @Saco	4/10/1992	7.0
2835/36.8	St. Francis R. @Saco	4/15/1992	4.0
2835/36.8	St. Francis R. @Saco	4/20/1992	373.0
2835/36.8	St. Francis R. @Saco	4/25/1992	68.0
2835/36.8	St. Francis R. @Saco	4/30/1992	5.0
2835/36.8	St. Francis R. @Saco	5/5/1992	25.0
2835/36.8	St. Francis R. @Saco	5/10/1992	4.0
2835/36.8	St. Francis R. @Saco	5/15/1992	6.0
2835/36.8	St. Francis R. @Saco	5/20/1992	6.0
2835/36.8	St. Francis R. @Saco	5/25/1992	154.0
2835/36.8	St. Francis R. @Saco	5/31/1992	16.0
2835/36.8	St. Francis R. @Saco	6/5/1992	15.0
2835/36.8	St. Francis R. @Saco	6/10/1992	11.0
2835/36.8	St. Francis R. @Saco	6/15/1992	22.0
2835/36.8	St. Francis R. @Saco	6/20/1992	19.0
2835/36.8	St. Francis R. @Saco	6/25/1992	29.0
2835/36.8	St. Francis R. @Saco	6/30/1992	23.0
2835/36.8	St. Francis R. @Saco	7/5/1992	17.0
2835/36.8	St. Francis R. @Saco	7/10/1992	18.0
2835/36.8	St. Francis R. @Saco	7/15/1992	13.0
2835/36.8	St. Francis R. @Saco	7/20/1992	12.0
2835/36.8	St. Francis R. @Saco	7/25/1992	26.0
2835/36.8	St. Francis R. @Saco	7/31/1992	21.0
2835/36.8	St. Francis R. @Saco	8/5/1992	6.0
2835/36.8	St. Francis R. @Saco	8/10/1992	8.0
2835/36.8	St. Francis R. @Saco	8/15/1992	20.0
2835/36.8	St. Francis R. @Saco	8/20/1992	19.0
2835/36.8	St. Francis R. @Saco	8/25/1992	14.0
2835/36.8	St. Francis R. @Saco	8/31/1992	11.0
2835/36.8	St. Francis R. @Saco	9/5/1992	18.0
2835/36.8	St. Francis R. @Saco	9/10/1992	20.0
2835/36.8	St. Francis R. @Saco	9/15/1992	22.0
2835/36.8	St. Francis R. @Saco	9/20/1992	25.0
2835/36.8	St. Francis R. @Saco	9/25/1992	21.0
2835/36.8	St. Francis R. @Saco	9/30/1992	20.0
2835/36.8	St. Francis R. @Saco	10/5/1992	22.0
2835/36.8	St. Francis R. @Saco	10/10/1992	18.0
2835/36.8	St. Francis R. @Saco	10/15/1992	11.0
2835/36.8	St. Francis R. @Saco	10/20/1992	23.0
2835/36.8	St. Francis R. @Saco	10/25/1992	25.0
2835/36.8	St. Francis R. @Saco	10/31/1992	10.0
2835/36.8	St. Francis R. @Saco	11/5/1992	19.0
2034/21.5	Bourbeuse R. above Union	11/9/1992	2.0
2835/36.8	St. Francis R. @Saco	11/10/1992	34.0
2835/36.8	St. Francis R. @Saco	11/15/1992	17.0

2835/36.8	St. Francis R. @Saco	11/20/1992	12.0
2835/36.8	St. Francis R. @Saco	11/25/1992	38.0
2835/36.8	St. Francis R. @Saco	11/30/1992	26.0
2835/36.8	St. Francis R. @Saco	12/5/1992	42.0
2835/36.8	St. Francis R. @Saco	12/10/1992	16.0
2835/36.8	St. Francis R. @Saco	12/31/1992	20.0
2835/36.8	St. Francis R. @Saco	1/5/1993	64.0
2034/21.5	Bourbeuse R. above Union	1/19/1993	1.0
2835/36.8	St. Francis R. @Saco	1/20/1993	6.0
2835/36.8	St. Francis R. @Saco	1/25/1993	4.0
2835/36.8	St. Francis R. @Saco	1/31/1993	8.0
2835/36.8	St. Francis R. @Saco	2/5/1993	11.0
2835/36.8	St. Francis R. @Saco	2/10/1993	10.0
2835/36.8	St. Francis R. @Saco	2/15/1993	12.0
2835/36.8	St. Francis R. @Saco	2/20/1993	9.0
2835/36.8	St. Francis R. @Saco	2/25/1993	8.0
2835/36.8	St. Francis R. @Saco	2/28/1993	6.0
2835/36.8	St. Francis R. @Saco	3/5/1993	24.0
2835/36.8	St. Francis R. @Saco	3/10/1993	2.0
2034/21.5	Bourbeuse R. above Union	3/15/1993	4.0
2835/36.8	St. Francis R. @Saco	3/15/1993	3.0
2835/36.8	St. Francis R. @Saco	3/20/1993	4.0
2835/36.8	St. Francis R. @Saco	3/25/1993	2.0
2835/36.8	St. Francis R. @Saco	3/31/1993	11.0
2835/36.8	St. Francis R. @Saco	4/5/1993	5.0
2835/36.8	St. Francis R. @Saco	4/10/1993	6.0
2835/36.8	St. Francis R. @Saco	4/15/1993	34.0
2835/36.8	St. Francis R. @Saco	4/20/1993	10.0
2835/36.8	St. Francis R. @Saco	4/25/1993	4.0
2835/36.8	St. Francis R. @Saco	4/30/1993	5.0
2835/36.8	St. Francis R. @Saco	5/5/1993	17.0
2835/36.8	St. Francis R. @Saco	5/10/1993	11.0
2835/36.8	St. Francis R. @Saco	5/15/1993	21.0
2034/21.5	Bourbeuse R. above Union	5/19/1993	136.0
2835/36.8	St. Francis R. @Saco	5/20/1993	8.0
2835/36.8	St. Francis R. @Saco	5/25/1993	10.0
2835/36.8	St. Francis R. @Saco	5/31/1993	13.0
2835/36.8	St. Francis R. @Saco	6/5/1993	8.0
2835/36.8	St. Francis R. @Saco	6/10/1993	9.0
2835/36.8	St. Francis R. @Saco	6/15/1993	23.0
2835/36.8	St. Francis R. @Saco	6/20/1993	16.0
2835/36.8	St. Francis R. @Saco	6/25/1993	13.0
2835/36.8	St. Francis R. @Saco	6/30/1993	14.0
2835/36.8	St. Francis R. @Saco	7/5/1993	8.0
2034/21.5	Bourbeuse R. above Union	7/6/1993	19.0
2835/36.8	St. Francis R. @Saco	7/10/1993	13.0
2835/36.8	St. Francis R. @Saco	7/15/1993	8.0
2835/36.8	St. Francis R. @Saco	7/20/1993	8.0
2835/36.8	St. Francis R. @Saco	7/25/1993	6.0

2835/36.8	St. Francis R. @Saco	7/31/1993	9.0
2835/36.8	St. Francis R. @Saco	8/5/1993	6.0
2835/36.8	St. Francis R. @Saco	8/10/1993	16.0
2835/36.8	St. Francis R. @Saco	8/15/1993	73.0
2835/36.8	St. Francis R. @Saco	8/20/1993	27.0
2835/36.8	St. Francis R. @Saco	8/25/1993	11.0
2835/36.8	St. Francis R. @Saco	8/31/1993	28.0
2835/36.8	St. Francis R. @Saco	9/5/1993	2.0
2835/36.8	St. Francis R. @Saco	9/10/1993	2.0
2835/36.8	St. Francis R. @Saco	9/15/1993	5.0
2835/36.8	St. Francis R. @Saco	9/20/1993	3.0
2835/36.8	St. Francis R. @Saco	9/25/1993	180.0
2034/21.5	Bourbeuse R. above Union	9/30/1993	36.0
2835/36.8	St. Francis R. @Saco	9/30/1993	75.0
2835/36.8	St. Francis R. @Saco	10/5/1993	13.0
2835/36.8	St. Francis R. @Saco	10/10/1993	9.0
2835/36.8	St. Francis R. @Saco	10/15/1993	7.0
2835/36.8	St. Francis R. @Saco	10/20/1993	4.0
2835/36.8	St. Francis R. @Saco	10/25/1993	4.0
2835/36.8	St. Francis R. @Saco	10/31/1993	7.0
2034/21.5	Bourbeuse R. above Union	11/3/1993	14.0
2835/36.8	St. Francis R. @Saco	11/5/1993	3.0
2835/36.8	St. Francis R. @Saco	11/10/1993	12.0
2835/36.8	St. Francis R. @Saco	11/15/1993	297.0
2835/36.8	St. Francis R. @Saco	11/20/1993	272.0
2835/36.8	St. Francis R. @Saco	11/25/1993	60.0
2835/36.8	St. Francis R. @Saco	11/30/1993	39.0
2835/36.8	St. Francis R. @Saco	12/5/1993	405.0
2835/36.8	St. Francis R. @Saco	12/10/1993	51.0
2835/36.8	St. Francis R. @Saco	12/15/1993	5.0
2835/36.8	St. Francis R. @Saco	12/20/1993	5.0
2835/36.8	St. Francis R. @Saco	12/25/1993	13.0
2835/36.8	St. Francis R. @Saco	12/31/1993	10.0
2835/36.8	St. Francis R. @Saco	1/5/1994	5.0
2835/36.8	St. Francis R. @Saco	1/10/1994	5.0
2835/36.8	St. Francis R. @Saco	1/15/1994	16.0
2034/21.5	Bourbeuse R. above Union	1/20/1994	6.0
2835/36.8	St. Francis R. @Saco	1/20/1994	8.0
2835/36.8	St. Francis R. @Saco	1/25/1994	204.0
2835/36.8	St. Francis R. @Saco	1/31/1994	36.0
2835/36.8	St. Francis R. @Saco	2/5/1994	13.0
2835/36.8	St. Francis R. @Saco	2/10/1994	10.0
2835/36.8	St. Francis R. @Saco	2/15/1994	8.0
2835/36.8	St. Francis R. @Saco	2/20/1994	13.0
2835/36.8	St. Francis R. @Saco	2/25/1994	21.0
2835/36.8	St. Francis R. @Saco	2/28/1994	11.0
2835/36.8	St. Francis R. @Saco	3/5/1994	3.0
2835/36.8	St. Francis R. @Saco	3/10/1994	4.0
2835/36.8	St. Francis R. @Saco	3/15/1994	5.0

2835/36.8	St. Francis R. @Saco	3/20/1994	1.0
2835/36.8	St. Francis R. @Saco	3/25/1994	2.0
2835/36.8	St. Francis R. @Saco	3/31/1994	2.0
2835/36.8	St. Francis R. @Saco	4/5/1994	6.0
2835/36.8	St. Francis R. @Saco	4/10/1994	39.0
2835/36.8	St. Francis R. @Saco	4/15/1994	19.0
2835/36.8	St. Francis R. @Saco	4/20/1994	15.0
2835/36.8	St. Francis R. @Saco	4/25/1994	12.0
2835/36.8	St. Francis R. @Saco	4/30/1994	268.0
2835/36.8	St. Francis R. @Saco	5/5/1994	9.0
2835/36.8	St. Francis R. @Saco	5/10/1994	7.0
2835/36.8	St. Francis R. @Saco	5/15/1994	9.0
2835/36.8	St. Francis R. @Saco	5/20/1994	8.0
2835/36.8	St. Francis R. @Saco	5/25/1994	6.0
2835/36.8	St. Francis R. @Saco	5/31/1994	4.0
2835/36.8	St. Francis R. @Saco	6/5/1994	5.0
2034/21.5	Bourbeuse R. above Union	6/7/1994	26.0
2835/36.8	St. Francis R. @Saco	6/10/1994	6.0
2835/36.8	St. Francis R. @Saco	6/15/1994	11.0
2835/36.8	St. Francis R. @Saco	6/20/1994	4.0
2835/36.8	St. Francis R. @Saco	6/25/1994	6.0
2835/36.8	St. Francis R. @Saco	6/30/1994	17.0
2835/36.8	St. Francis R. @Saco	7/5/1994	30.0
2835/36.8	St. Francis R. @Saco	7/10/1994	36.0
2835/36.8	St. Francis R. @Saco	7/15/1994	30.0
2835/36.8	St. Francis R. @Saco	7/20/1994	25.0
2835/36.8	St. Francis R. @Saco	7/25/1994	1.0
2835/36.8	St. Francis R. @Saco	7/31/1994	2.0
2034/21.5	Bourbeuse R. above Union	8/2/1994	30.0
2835/36.8	St. Francis R. @Saco	8/5/1994	9.0
2835/36.8	St. Francis R. @Saco	8/10/1994	1.0
2835/36.8	St. Francis R. @Saco	8/15/1994	7.0
2835/36.8	St. Francis R. @Saco	8/20/1994	12.0
2835/36.8	St. Francis R. @Saco	8/25/1994	3.0
2835/36.8	St. Francis R. @Saco	8/31/1994	32.0
2835/36.8	St. Francis R. @Saco	9/5/1994	5.0
2835/36.8	St. Francis R. @Saco	9/10/1994	4.0
2835/36.8	St. Francis R. @Saco	9/15/1994	6.0
2835/36.8	St. Francis R. @Saco	9/20/1994	2.0
2835/36.8	St. Francis R. @Saco	9/25/1994	6.0
2835/36.8	St. Francis R. @Saco	9/30/1994	4.0
2835/36.8	St. Francis R. @Saco	10/5/1994	5.0
2835/36.8	St. Francis R. @Saco	10/10/1994	3.0
2835/36.8	St. Francis R. @Saco	10/15/1994	7.0
2835/36.8	St. Francis R. @Saco	10/20/1994	7.0
2835/36.8	St. Francis R. @Saco	10/25/1994	4.0
2835/36.8	St. Francis R. @Saco	10/31/1994	4.0
2034/21.5	Bourbeuse R. above Union	11/3/1994	8.0
2835/36.8	St. Francis R. @Saco	11/5/1994	107.0

2835/36.8	St. Francis R. @Saco	11/10/1994	16.0
2835/36.8	St. Francis R. @Saco	11/15/1994	8.0
2835/36.8	St. Francis R. @Saco	11/20/1994	7.0
2835/36.8	St. Francis R. @Saco	11/25/1994	7.0
2835/36.8	St. Francis R. @Saco	11/30/1994	8.0
2835/36.8	St. Francis R. @Saco	12/5/1994	5.0
2835/36.8	St. Francis R. @Saco	12/10/1994	23.0
2835/36.8	St. Francis R. @Saco	12/15/1994	6.0
2835/36.8	St. Francis R. @Saco	12/20/1994	4.0
2835/36.8	St. Francis R. @Saco	12/25/1994	12.0
2835/36.8	St. Francis R. @Saco	12/31/1994	7.0
2034/21.5	Bourbeuse R. above Union	1/4/1995	2.0
2835/36.8	St. Francis R. @Saco	1/5/1995	5.0
2835/36.8	St. Francis R. @Saco	1/10/1995	7.0
2835/36.8	St. Francis R. @Saco	1/15/1995	30.0
2835/36.8	St. Francis R. @Saco	1/20/1995	38.0
2835/36.8	St. Francis R. @Saco	1/25/1995	11.0
2835/36.8	St. Francis R. @Saco	1/31/1995	6.0
2835/36.8	St. Francis R. @Saco	2/5/1995	4.0
2835/36.8	St. Francis R. @Saco	2/10/1995	4.0
2835/36.8	St. Francis R. @Saco	2/15/1995	5.0
2835/36.8	St. Francis R. @Saco	2/20/1995	7.0
2835/36.8	St. Francis R. @Saco	2/25/1995	5.0
2835/36.8	St. Francis R. @Saco	2/28/1995	65.0
2835/36.8	St. Francis R. @Saco	3/5/1995	12.0
2835/36.8	St. Francis R. @Saco	3/10/1995	22.0
2835/36.8	St. Francis R. @Saco	3/15/1995	7.0
2835/36.8	St. Francis R. @Saco	3/20/1995	5.0
2835/36.8	St. Francis R. @Saco	3/25/1995	3.0
2835/36.8	St. Francis R. @Saco	3/31/1995	4.0
2835/36.8	St. Francis R. @Saco	4/5/1995	2.0
2835/36.8	St. Francis R. @Saco	4/10/1995	3.0
2835/36.8	St. Francis R. @Saco	4/15/1995	4.0
2835/36.8	St. Francis R. @Saco	4/20/1995	4.0
2835/36.8	St. Francis R. @Saco	4/25/1995	8.0
2835/36.8	St. Francis R. @Saco	4/30/1995	7.0
2835/36.8	St. Francis R. @Saco	5/5/1995	15.0
2835/36.8	St. Francis R. @Saco	5/10/1995	44.0
2835/36.8	St. Francis R. @Saco	5/15/1995	9.0
2835/36.8	St. Francis R. @Saco	5/20/1995	30.0
2835/36.8	St. Francis R. @Saco	5/25/1995	9.0
2835/36.8	St. Francis R. @Saco	5/31/1995	7.0
2835/36.8	St. Francis R. @Saco	6/5/1995	5.0
2835/36.8	St. Francis R. @Saco	6/10/1995	12.0
2034/21.5	Bourbeuse R. above Union	6/14/1995	48.0
2835/36.8	St. Francis R. @Saco	6/15/1995	3.0
2835/36.8	St. Francis R. @Saco	6/20/1995	3.0
2835/36.8	St. Francis R. @Saco	6/25/1995	3.0
2835/36.8	St. Francis R. @Saco	6/30/1995	8.0

2835/36.8	St. Francis R. @Saco	7/5/1995	8.0
2835/36.8	St. Francis R. @Saco	7/10/1995	7.0
2835/36.8	St. Francis R. @Saco	7/15/1995	8.0
2835/36.8	St. Francis R. @Saco	7/20/1995	4.0
2835/36.8	St. Francis R. @Saco	7/25/1995	10.0
2835/36.8	St. Francis R. @Saco	7/31/1995	13.0
2034/21.5	Bourbeuse R. above Union	8/2/1995	8.0
2835/36.8	St. Francis R. @Saco	8/5/1995	13.0
2835/36.8	St. Francis R. @Saco	8/10/1995	22.0
2835/36.8	St. Francis R. @Saco	8/15/1995	12.0
2835/36.8	St. Francis R. @Saco	8/20/1995	26.0
2835/36.8	St. Francis R. @Saco	8/25/1995	17.0
2835/36.8	St. Francis R. @Saco	8/31/1995	10.0
2835/36.8	St. Francis R. @Saco	9/5/1995	17.0
2835/36.8	St. Francis R. @Saco	9/10/1995	13.0
2835/36.8	St. Francis R. @Saco	9/15/1995	16.0
2835/36.8	St. Francis R. @Saco	9/20/1995	16.0
2835/36.8	St. Francis R. @Saco	9/25/1995	14.0
2835/36.8	St. Francis R. @Saco	9/30/1995	22.0
2835/36.8	St. Francis R. @Saco	10/5/1995	5.0
2835/36.8	St. Francis R. @Saco	10/10/1995	11.0
2835/36.8	St. Francis R. @Saco	10/15/1995	12.0
2835/36.8	St. Francis R. @Saco	10/20/1995	5.0
2835/36.8	St. Francis R. @Saco	10/25/1995	12.0
2835/36.8	St. Francis R. @Saco	10/31/1995	7.0
2835/36.8	St. Francis R. @Saco	11/5/1995	10.0
2835/36.8	St. Francis R. @Saco	11/10/1995	9.0
2835/36.8	St. Francis R. @Saco	11/15/1995	22.0
2835/36.8	St. Francis R. @Saco	11/20/1995	16.0
2034/21.5	Bourbeuse R. above Union	11/21/1995	1.0
2835/36.8	St. Francis R. @Saco	11/25/1995	16.0
2835/36.8	St. Francis R. @Saco	11/30/1995	22.0
2835/36.8	St. Francis R. @Saco	1/5/1996	11.0
2835/36.8	St. Francis R. @Saco	1/10/1996	12.0
2835/36.8	St. Francis R. @Saco	1/15/1996	14.0
2835/36.8	St. Francis R. @Saco	1/20/1996	18.0
2034/21.5	Bourbeuse R. above Union	1/22/1996	81.0
2835/36.8	St. Francis R. @Saco	1/25/1996	21.0
2835/36.8	St. Francis R. @Saco	2/10/1996	6.0
2835/36.8	St. Francis R. @Saco	2/15/1996	13.0
2835/36.8	St. Francis R. @Saco	2/20/1996	23.0
2835/36.8	St. Francis R. @Saco	2/25/1996	28.0
2835/36.8	St. Francis R. @Saco	2/29/1996	29.0
2835/36.8	St. Francis R. @Saco	3/5/1996	37.0
2835/36.8	St. Francis R. @Saco	3/10/1996	15.0
2835/36.8	St. Francis R. @Saco	4/20/1996	55.0
2835/36.8	St. Francis R. @Saco	4/25/1996	25.0
2835/36.8	St. Francis R. @Saco	4/30/1996	32.0
2835/36.8	St. Francis R. @Saco	5/5/1996	16.0

2835/36.8	St. Francis R. @Saco	5/10/1996	29.0
2835/36.8	St. Francis R. @Saco	5/15/1996	19.0
2835/36.8	St. Francis R. @Saco	5/20/1996	7.0
2835/36.8	St. Francis R. @Saco	5/25/1996	11.0
2835/36.8	St. Francis R. @Saco	5/31/1996	9.0
2034/21.5	Bourbeuse R. above Union	6/3/1996	14.0
2835/36.8	St. Francis R. @Saco	6/5/1996	9.0
2835/36.8	St. Francis R. @Saco	6/10/1996	22.0
2835/36.8	St. Francis R. @Saco	6/15/1996	23.0
2835/36.8	St. Francis R. @Saco	6/20/1996	15.0
2835/36.8	St. Francis R. @Saco	6/25/1996	20.0
2835/36.8	St. Francis R. @Saco	6/30/1996	25.0
2835/36.8	St. Francis R. @Saco	7/5/1996	18.0
2835/36.8	St. Francis R. @Saco	7/10/1996	16.0
2835/36.8	St. Francis R. @Saco	7/15/1996	24.0
2835/36.8	St. Francis R. @Saco	7/20/1996	6.0
2835/36.8	St. Francis R. @Saco	7/25/1996	26.0
2835/36.8	St. Francis R. @Saco	7/31/1996	18.0
2835/36.8	St. Francis R. @Saco	8/5/1996	15.0
2835/36.8	St. Francis R. @Saco	8/10/1996	16.0
2835/36.8	St. Francis R. @Saco	8/15/1996	19.0
2034/21.5	Bourbeuse R. above Union	8/20/1996	6.0
2835/36.8	St. Francis R. @Saco	8/20/1996	12.0
2835/36.8	St. Francis R. @Saco	8/25/1996	16.0
2835/36.8	St. Francis R. @Saco	8/31/1996	9.0
2835/36.8	St. Francis R. @Saco	9/5/1996	13.0
2835/36.8	St. Francis R. @Saco	9/10/1996	18.0
2835/36.8	St. Francis R. @Saco	9/15/1996	13.0
2835/36.8	St. Francis R. @Saco	9/20/1996	20.0
2835/36.8	St. Francis R. @Saco	9/25/1996	32.0
2835/36.8	St. Francis R. @Saco	9/30/1996	14.0
2034/21.5	Bourbeuse R. above Union	11/13/1996	23.0
2034/21.5	Bourbeuse R. above Union	1/8/1997	1.0
2034/21.5	Bourbeuse R. above Union	6/17/1997	52.0
2034/21.5	Bourbeuse R. above Union	8/6/1997	13.0
2034/21.5	Bourbeuse R. above Union	11/14/1997	8.0
2034/21.5	Bourbeuse R. above Union	5/18/1998	12.0
2034/21.5	Bourbeuse R. above Union	11/18/1998	7.0
2034/21.5	Bourbeuse R. above Union	5/20/1999	12.0
2835/36.8	St. Francis R. @Saco	11/2/1999	<1.0
847/23.2	Lamine R. nr. Pilot Grove	11/8/1999	17.0
2034/21.5	Bourbeuse R. above Union	11/24/1999	2.0
847/23.2	Lamine R. nr. Pilot Grove	5/2/2000	22.0
2835/36.8	St. Francis R. @Saco	5/10/2000	<10.0
2034/21.5	Bourbeuse R. above Union	5/24/2000	<10.0
847/23.2	Lamine R. nr. Pilot Grove	7/11/2000	30.0
2835/36.8	St. Francis R. @Saco	11/14/2000	<10.0
847/23.2	Lamine R. nr. Pilot Grove	11/21/2000	14.0
2034/21.5	Bourbeuse R. above Union	11/29/2000	<10.0

847/23.2	Lamine R. nr. Pilot Grove	5/2/2001	31.0
2835/36.8	St. Francis R. @Saco	5/9/2001	<10.0
2034/21.5	Bourbeuse R. above Union	5/17/2001	11.0
847/23.2	Lamine R. nr. Pilot Grove	7/11/2001	71.0
847/23.2	Lamine R. nr. Pilot Grove	11/6/2001	74.0
2835/36.8	St. Francis R. @Saco	11/13/2001	58.0
2034/21.5	Bourbeuse R. above Union	11/15/2001	12.0
847/23.2	Lamine R. nr. Pilot Grove	1/8/2002	<10.0
2034/21.5	Bourbeuse R. above Union	1/16/2002	<10.0
2835/36.8	St. Francis R. @Saco	1/23/2002	<10.0
847/23.2	Lamine R. nr. Pilot Grove	2/4/2002	68.0
2835/36.8	St. Francis R. @Saco	3/6/2002	<10.0
847/23.2	Lamine R. nr. Pilot Grove	3/6/2002	26.0
2034/21.5	Bourbeuse R. above Union	3/13/2002	18.0
847/23.2	Lamine R. nr. Pilot Grove	4/10/2002	28.0
847/23.2	Lamine R. nr. Pilot Grove	5/7/2002	395.0
2835/36.8	St. Francis R. @Saco	5/15/2002	15.0
2034/21.5	Bourbeuse R. above Union	5/16/2002	56.0
847/23.2	Lamine R. nr. Pilot Grove	6/11/2002	26.0
2034/21.5	Bourbeuse R. above Union	7/10/2002	26.0
2835/36.8	St. Francis R. @Saco	7/15/2002	<40.0
847/23.2	Lamine R. nr. Pilot Grove	7/16/2002	111.0
2835/36.8	St. Francis R. @Saco	9/4/2002	<10.0
2034/21.5	Bourbeuse R. above Union	9/5/2002	<10.0
847/23.2	Lamine R. nr. Pilot Grove	9/5/2002	23.0
2034/21.5	Bourbeuse R. above Union	11/5/2002	<10.0
847/23.2	Lamine R. nr. Pilot Grove	11/12/2002	<10.0
2835/36.8	St. Francis R. @Saco	11/19/2002	<10.0
2835/36.8	St. Francis R. @Saco	1/7/2003	<10.0
2034/21.5	Bourbeuse R. above Union	1/8/2003	<10.0
847/23.2	Lamine R. nr. Pilot Grove	1/13/2003	<10.0
847/23.2	Lamine R. nr. Pilot Grove	2/3/2003	<10.0
2034/21.5	Bourbeuse R. above Union	3/5/2003	27.0
2835/36.8	St. Francis R. @Saco	3/10/2003	<10.0
847/23.2	Lamine R. nr. Pilot Grove	3/10/2003	<10.0
847/23.2	Lamine R. nr. Pilot Grove	4/9/2003	39.0
2835/36.8	St. Francis R. @Saco	5/20/2003	<10.0
2034/21.5	Bourbeuse R. above Union	5/21/2003	17.0
847/23.2	Lamine R. nr. Pilot Grove	5/27/2003	36.0
847/23.2	Lamine R. nr. Pilot Grove	6/16/2003	64.0
2835/36.8	St. Francis R. @Saco	7/8/2003	<10.0
847/23.2	Lamine R. nr. Pilot Grove	7/15/2003	12.0
2034/21.5	Bourbeuse R. above Union	7/23/2003	<10.0
847/23.2	Lamine R. nr. Pilot Grove	9/3/2003	106.0
2034/21.5	Bourbeuse R. above Union	9/4/2003	8.0
2835/36.8	St. Francis R. @Saco	9/4/2003	<10.0
2034/21.5	Bourbeuse R. above Union	11/12/2003	<10.0
2034/21.5	Bourbeuse R. above Union	11/12/2003	<10.0
2835/36.8	St. Francis R. @Saco	11/19/2003	61.0

847/23.2	Lamine R. nr. Pilot Grove	11/24/2003	16.0
2034/21.5	Bourbeuse R. above Union	1/12/2004	11.0
847/23.2	Lamine R. nr. Pilot Grove	1/14/2004	15.0
2835/36.8	St. Francis R. @Saco	1/20/2004	14.0
847/23.2	Lamine R. nr. Pilot Grove	2/2/2004	11.0
2034/21.5	Bourbeuse R. above Union	3/1/2004	14.0
847/23.2	Lamine R. nr. Pilot Grove	3/9/2004	90.0
2835/36.8	St. Francis R. @Saco	3/16/2004	<10.0
847/23.2	Lamine R. nr. Pilot Grove	4/19/2004	17.0
2034/21.5	Bourbeuse R. above Union	5/4/2004	64.0
2835/36.8	St. Francis R. @Saco	5/4/2004	14.0
847/23.2	Lamine R. nr. Pilot Grove	5/20/2004	548.0
847/23.2	Lamine R. nr. Pilot Grove	6/15/2004	166.0
847/23.2	Lamine R. nr. Pilot Grove	7/6/2004	460.0
2835/36.8	St. Francis R. @Saco	7/7/2004	<10.0
2034/21.5	Bourbeuse R. above Union	7/19/2004	12.0
2835/36.8	St. Francis R. @Saco	9/7/2004	<10.0
847/23.2	Lamine R. nr. Pilot Grove	9/20/2004	29.0
2034/21.5	Bourbeuse R. above Union	9/22/2004	<10.0
2034/21.5	Bourbeuse R. above Union	9/22/2004	<10.0
2034/21.5	Bourbeuse R. above Union	11/3/2004	110.0
2835/36.8	St. Francis R. @Saco	11/23/2004	<10.0
847/23.2	Lamine R. nr. Pilot Grove	11/30/2004	123.0
2034/21.5	Bourbeuse R. above Union	1/6/2005	278.0
847/23.2	Lamine R. nr. Pilot Grove	1/24/2005	27.0
2835/36.8	St. Francis R. @Saco	1/25/2005	<10.0
847/23.2	Lamine R. nr. Pilot Grove	2/15/2005	182.0
847/23.2	Lamine R. nr. Pilot Grove	3/8/2005	135.0
2034/21.5	Bourbeuse R. above Union	3/10/2005	14.0
2835/36.8	St. Francis R. @Saco	3/15/2005	<10.0
847/23.2	Lamine R. nr. Pilot Grove	4/4/2005	26.0
847/23.2	Lamine R. nr. Pilot Grove	5/2/2005	29.0
2034/21.5	Bourbeuse R. above Union	5/3/2005	24.0
2835/36.8	St. Francis R. @Saco	5/17/2005	<10.0
847/23.2	Lamine R. nr. Pilot Grove	6/22/2005	56.0
847/23.2	Lamine R. nr. Pilot Grove	7/12/2005	36.0
2835/36.8	St. Francis R. @Saco	7/19/2005	<10.0
2034/21.5	Bourbeuse R. above Union	7/25/2005	<10.0
2835/36.8	St. Francis R. @Saco	9/6/2005	<10.0
2034/21.5	Bourbeuse R. above Union	9/7/2005	31.0
847/23.2	Lamine R. nr. Pilot Grove	9/7/2005	15.0
2835/36.8	St. Francis R. @Saco	11/2/2005	<10.0
847/23.2	Lamine R. nr. Pilot Grove	11/2/2005	20.0
2034/21.5	Bourbeuse R. above Union	11/9/2005	<10.0
2835/36.8	St. Francis R. @Saco	1/3/2006	<10.0
2835/36.8	St. Francis R. @Saco	1/3/2006	<10.0
847/23.2	Lamine R. nr. Pilot Grove	1/3/2006	<10.0
2034/21.5	Bourbeuse R. above Union	1/9/2006	11.0
847/23.2	Lamine R. nr. Pilot Grove	2/6/2006	<10.0

2034/21.5	Bourbeuse R. above Union	3/6/2006	<10.0
2835/36.8	St. Francis R. @Saco	3/6/2006	<10.0
847/23.2	Lamine R. nr. Pilot Grove	3/7/2006	12.0
847/23.2	Lamine R. nr. Pilot Grove	4/10/2006	30.0
847/23.2	Lamine R. nr. Pilot Grove	5/4/2006	58.0
2835/36.8	St. Francis R. @Saco	5/8/2006	<10.0
2034/21.5	Bourbeuse R. above Union	5/16/2006	25.0
2034/21.5	Bourbeuse R. above Union	5/16/2006	21.0
847/23.2	Lamine R. nr. Pilot Grove	6/14/2006	62.0
847/23.2	Lamine R. nr. Pilot Grove	7/6/2006	27.0
2835/36.8	St. Francis R. @Saco	7/10/2006	<10.0
2034/21.5	Bourbeuse R. above Union	7/26/2006	<10.0
2034/21.5	Bourbeuse R. above Union	9/5/2006	16.0
847/23.2	Lamine R. nr. Pilot Grove	9/6/2006	50.0
2835/36.8	St. Francis R. @Saco	9/12/2006	<10.0
847/23.2	Lamine R. nr. Pilot Grove	11/6/2006	16.0
847/23.2	Lamine R. nr. Pilot Grove	11/6/2006	14.0
2034/21.5	Bourbeuse R. above Union	11/7/2006	<10.0
2034/21.5	Bourbeuse R. above Union	11/7/2006	10.0
2835/36.8	St. Francis R. @Saco	11/14/2006	<10.0
847/23.2	Lamine R. nr. Pilot Grove	1/4/2007	78.0
2034/21.5	Bourbeuse R. above Union	1/8/2007	<10.0
2835/36.8	St. Francis R. @Saco	1/24/2007	<10.0
2034/21.5	Bourbeuse R. above Union	2/12/2007	<10.0
2835/36.8	St. Francis R. @Saco	2/13/2007	91.0
847/23.2	Lamine R. nr. Pilot Grove	2/14/2007	183.0
2835/36.8	St. Francis R. @Saco	3/6/2007	<10.0
847/23.2	Lamine R. nr. Pilot Grove	3/7/2007	60.0
2034/21.5	Bourbeuse R. above Union	3/12/2007	<10.0
2835/36.8	St. Francis R. @Saco	4/3/2007	13.0
847/23.2	Lamine R. nr. Pilot Grove	4/3/2007	80.0
2034/21.5	Bourbeuse R. above Union	4/12/2007	<10.0
2835/36.8	St. Francis R. @Saco	5/1/2007	<10.0
2835/36.8	St. Francis R. @Saco	5/1/2007	<10.0
847/23.2	Lamine R. nr. Pilot Grove	5/3/2007	460.0
2034/21.5	Bourbeuse R. above Union	5/21/2007	<10.0
2034/21.5	Bourbeuse R. above Union	6/4/2007	<10.0
847/23.2	Lamine R. nr. Pilot Grove	6/6/2007	106.0
2835/36.8	St. Francis R. @Saco	6/11/2007	<10.0
2034/21.5	Bourbeuse R. above Union	7/9/2007	14.0
847/23.2	Lamine R. nr. Pilot Grove	7/10/2007	42.0
2835/36.8	St. Francis R. @Saco	7/16/2007	<10.0
2835/36.8	St. Francis R. @Saco	9/4/2007	<10.0
2034/21.5	Bourbeuse R. above Union	9/5/2007	<10.0
847/23.2	Lamine R. nr. Pilot Grove	9/11/2007	30.0
2034/21.5	Bourbeuse R. above Union	11/6/2007	<10.0
847/23.2	Lamine R. nr. Pilot Grove	11/6/2007	31.0
2835/36.8	St. Francis R. @Saco	11/26/2007	<10.0
847/23.2	Lamine R. nr. Pilot Grove	1/9/2008	310.0

2835/36.8	St. Francis R. @Saco	1/14/2008	<10.0
2034/21.5	Bourbeuse R. above Union	1/24/2008	<10.0
847/23.2	Lamine R. nr. Pilot Grove	3/6/2008	152.0
2835/36.8	St. Francis R. @Saco	3/12/2008	<10.0
2034/21.5	Bourbeuse R. above Union	3/25/2008	30.0
847/23.2	Lamine R. nr. Pilot Grove	5/6/2008	28.0
2835/36.8	St. Francis R. @Saco	5/7/2008	<10.0
2034/21.5	Bourbeuse R. above Union	5/22/2008	10.0
2835/36.8	St. Francis R. @Saco	7/7/2008	<10.0
847/23.2	Lamine R. nr. Pilot Grove	7/9/2008	69.0
2034/21.5	Bourbeuse R. above Union	7/22/2008	16.0
847/23.2	Lamine R. nr. Pilot Grove	9/2/2008	22.0
2034/21.5	Bourbeuse R. above Union	9/4/2008	94.0
2835/36.8	St. Francis R. @Saco	9/8/2008	<10.0
847/23.2	Lamine R. nr. Pilot Grove	1/12/2009	<15.0
2835/36.8	St. Francis R. @Saco	1/13/2009	<15.0
2034/21.5	Bourbeuse R. above Union	1/20/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	1/26/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	2/3/2009	<15.0
2835/36.8	St. Francis R. @Saco	3/3/2009	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/9/2009	32.0
1344/6.2	Cedar Cr. @ Hwy 39	3/17/2009	<15.0
2034/21.5	Bourbeuse R. above Union	3/24/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	4/7/2009	<15.0
2034/21.5	Bourbeuse R. above Union	4/20/2009	318.0
2835/36.8	St. Francis R. @Saco	4/27/2009	77.0
847/23.2	Lamine R. nr. Pilot Grove	5/5/2009	110.0
1344/6.2	Cedar Cr. @ Hwy 39	5/19/2009	<30.0
2835/36.8	St. Francis R. @Saco	5/26/2009	<15.0
2034/21.5	Bourbeuse R. above Union	5/27/2009	49.0
2034/21.5	Bourbeuse R. above Union	6/1/2009	40.0
2835/36.8	St. Francis R. @Saco	6/1/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	6/2/2009	<15.0
2835/36.8	St. Francis R. @Saco	7/6/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	7/7/2009	23.0
2034/21.5	Bourbeuse R. above Union	7/22/2009	15.0
847/23.2	Lamine R. nr. Pilot Grove	7/29/2009	45.0
2835/36.8	St. Francis R. @Saco	8/5/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	8/18/2009	<15.0
2034/21.5	Bourbeuse R. above Union	8/24/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	9/1/2009	<15.0
2034/21.5	Bourbeuse R. above Union	9/2/2009	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/2/2009	17.0
2835/36.8	St. Francis R. @Saco	9/8/2009	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	10/6/2009	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/16/2009	153.0
2835/36.8	St. Francis R. @Saco	10/27/2009	<15.0
2034/21.5	Bourbeuse R. above Union	10/28/2009	69.0
1344/6.2	Cedar Cr. @ Hwy 39	11/2/2009	<15.0

1344/6.2	Cedar Cr. @ Hwy 39	12/7/2009	<15.0
847/23.2	Lamine R. nr. Pilot Grove	1/14/2010	<15.0
2034/21.5	Bourbeuse R. above Union	1/19/2010	<15.0
2835/36.8	St. Francis R. @Saco	1/19/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	1/20/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	2/1/2010	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/2/2010	28.0
1344/6.2	Cedar Cr. @ Hwy 39	3/9/2010	<15.0
2835/36.8	St. Francis R. @Saco	3/9/2010	<15.0
2034/21.5	Bourbeuse R. above Union	3/23/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	4/6/2010	<15.0
2835/36.8	St. Francis R. @Saco	4/7/2010	<15.0
847/23.2	Lamine R. nr. Pilot Grove	4/14/2010	41.0
2034/21.5	Bourbeuse R. above Union	4/19/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	5/4/2010	19.0
2034/21.5	Bourbeuse R. above Union	5/25/2010	42.0
2835/36.8	St. Francis R. @Saco	5/26/2010	<15.0
847/23.2	Lamine R. nr. Pilot Grove	5/26/2010	540.0
1344/6.2	Cedar Cr. @ Hwy 39	6/2/2010	<15.0
2835/36.8	St. Francis R. @Saco	6/14/2010	<15.0
847/23.2	Lamine R. nr. Pilot Grove	6/15/2010	24.0
2034/21.5	Bourbeuse R. above Union	6/16/2010	38.0
847/23.2	Lamine R. nr. Pilot Grove	7/6/2010	94.0
1344/6.2	Cedar Cr. @ Hwy 39	7/7/2010	22.0
2034/21.5	Bourbeuse R. above Union	7/12/2010	25.0
2835/36.8	St. Francis R. @Saco	7/27/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	8/3/2010	18.0
847/23.2	Lamine R. nr. Pilot Grove	8/3/2010	47.0
2034/21.5	Bourbeuse R. above Union	8/9/2010	<15.0
2835/36.8	St. Francis R. @Saco	8/17/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	9/2/2010	86.0
2034/21.5	Bourbeuse R. above Union	9/8/2010	28.0
2835/36.8	St. Francis R. @Saco	9/8/2010	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/15/2010	90.0
847/23.2	Lamine R. nr. Pilot Grove	10/6/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	10/13/2010	<15.0
2034/21.5	Bourbeuse R. above Union	10/19/2010	<15.0
2835/36.8	St. Francis R. @Saco	10/27/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	11/9/2010	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	12/1/2010	<15.0
2034/21.5	Bourbeuse R. above Union	1/4/2011	62.0
847/23.2	Lamine R. nr. Pilot Grove	1/6/2011	50.0
2835/36.8	St. Francis R. @Saco	1/10/2011	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	1/13/2011	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	2/7/2011	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/9/2011	90.0
2835/36.8	St. Francis R. @Saco	3/22/2011	<15.0
2034/21.5	Bourbeuse R. above Union	3/23/2011	26.0
1344/6.2	Cedar Cr. @ Hwy 39	3/30/2011	<15.0

2034/21.5	Bourbeuse R. above Union	4/4/2011	28.0
2835/36.8	St. Francis R. @Saco	4/12/2011	43.0
847/23.2	Lamine R. nr. Pilot Grove	4/19/2011	44.0
1344/6.2	Cedar Cr. @ Hwy 39	4/20/2011	23.0
2034/21.5	Bourbeuse R. above Union	5/3/2011	26.0
847/23.2	Lamine R. nr. Pilot Grove	5/4/2011	23.0
1344/6.2	Cedar Cr. @ Hwy 39	5/10/2011	16.0
2835/36.8	St. Francis R. @Saco	5/11/2011	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	6/7/2011	<15.0
2835/36.8	St. Francis R. @Saco	6/13/2011	<15.0
847/23.2	Lamine R. nr. Pilot Grove	6/14/2011	60.0
2034/21.5	Bourbeuse R. above Union	6/15/2011	<15.0
2835/36.8	St. Francis R. @Saco	7/5/2011	<15.0
2034/21.5	Bourbeuse R. above Union	7/12/2011	26.0
847/23.2	Lamine R. nr. Pilot Grove	7/13/2011	<30.0
1344/6.2	Cedar Cr. @ Hwy 39	7/26/2011	<15.0
2835/36.8	St. Francis R. @Saco	8/1/2011	<15.0
847/23.2	Lamine R. nr. Pilot Grove	8/3/2011	<30.0
1344/6.2	Cedar Cr. @ Hwy 39	8/9/2011	<30.0
2034/21.5	Bourbeuse R. above Union	8/9/2011	<15.0
2034/21.5	Bourbeuse R. above Union	9/6/2011	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	9/7/2011	23.0
2835/36.8	St. Francis R. @Saco	9/7/2011	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/8/2011	39.0
1344/6.2	Cedar Cr. @ Hwy 39	10/4/2011	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/13/2011	21.0
2835/36.8	St. Francis R. @Saco	10/18/2011	<15.0
2034/21.5	Bourbeuse R. above Union	10/26/2011	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	11/1/2011	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	12/5/2011	16.0
2835/36.8	St. Francis R. @Saco	1/3/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	1/12/2012	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	1/18/2012	<15.0
2034/21.5	Bourbeuse R. above Union	1/23/2012	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	2/15/2012	<15.0
2034/21.5	Bourbeuse R. above Union	3/6/2012	<15.0
2835/36.8	St. Francis R. @Saco	3/6/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/7/2012	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	3/14/2012	<15.0
2835/36.8	St. Francis R. @Saco	4/2/2012	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	4/3/2012	<15.0
2034/21.5	Bourbeuse R. above Union	4/9/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	4/11/2012	<15.0
2034/21.5	Bourbeuse R. above Union	5/1/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	5/3/2012	213.0
1344/6.2	Cedar Cr. @ Hwy 39	5/8/2012	120.0
2835/36.8	St. Francis R. @Saco	5/9/2012	<15.0
2034/21.5	Bourbeuse R. above Union	6/4/2012	<15.0
2835/36.8	St. Francis R. @Saco	6/4/2012	<15.0

1344/6.2	Cedar Cr. @ Hwy 39	6/6/2012	18.0
847/23.2	Lamine R. nr. Pilot Grove	6/6/2012	36.0
847/23.2	Lamine R. nr. Pilot Grove	7/19/2012	56.0
2034/21.5	Bourbeuse R. above Union	7/30/2012	<15.0
2835/36.8	St. Francis R. @Saco	8/7/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	8/7/2012	31.0
2034/21.5	Bourbeuse R. above Union	8/8/2012	<15.0
2034/21.5	Bourbeuse R. above Union	9/4/2012	<15.0
2835/36.8	St. Francis R. @Saco	9/4/2012	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	9/5/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/6/2012	22.0
1344/6.2	Cedar Cr. @ Hwy 39	9/12/2012	<15.0
2034/21.5	Bourbeuse R. above Union	10/2/2012	15.0
847/23.2	Lamine R. nr. Pilot Grove	10/3/2012	<15.0
2835/36.8	St. Francis R. @Saco	10/9/2012	<30.0
1344/6.2	Cedar Cr. @ Hwy 39	10/23/2012	<30.0
1344/6.2	Cedar Cr. @ Hwy 39	11/13/2012	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	12/5/2012	<15.0
847/23.2	Lamine R. nr. Pilot Grove	1/9/2013	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	1/15/2013	<15.0
2034/21.5	Bourbeuse R. above Union	1/29/2013	<15.0
2835/36.8	St. Francis R. @Saco	1/29/2013	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	2/4/2013	<15.0
2034/21.5	Bourbeuse R. above Union	3/5/2013	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/6/2013	58.0
1344/6.2	Cedar Cr. @ Hwy 39	3/7/2013	<15.0
2835/36.8	St. Francis R. @Saco	3/19/2013	35.0
2034/21.5	Bourbeuse R. above Union	4/1/2013	<15.0
847/23.2	Lamine R. nr. Pilot Grove	4/1/2013	44.0
1344/6.2	Cedar Cr. @ Hwy 39	4/2/2013	26.0
2835/36.8	St. Francis R. @Saco	4/9/2013	<15.0
847/23.2	Lamine R. nr. Pilot Grove	5/8/2013	26.0
2034/21.5	Bourbeuse R. above Union	5/21/2013	440.0
1344/6.2	Cedar Cr. @ Hwy 39	5/22/2013	124.0
2835/36.8	St. Francis R. @Saco	5/29/2013	18.0
1344/6.2	Cedar Cr. @ Hwy 39	6/4/2013	26.0
2835/36.8	St. Francis R. @Saco	6/10/2013	<15.0
2034/21.5	Bourbeuse R. above Union	6/18/2013	52.0
847/23.2	Lamine R. nr. Pilot Grove	6/19/2013	55.0
1344/6.2	Cedar Cr. @ Hwy 39	7/16/2013	<15.0
2835/36.8	St. Francis R. @Saco	7/16/2013	<15.0
2034/21.5	Bourbeuse R. above Union	7/23/2013	20.0
847/23.2	Lamine R. nr. Pilot Grove	8/1/2013	34.0
2835/36.8	St. Francis R. @Saco	8/7/2013	64.0
1344/6.2	Cedar Cr. @ Hwy 39	8/19/2013	<15.0
2034/21.5	Bourbeuse R. above Union	8/20/2013	<15.0
847/23.2	Lamine R. nr. Pilot Grove	8/21/2013	24.0
1344/6.2	Cedar Cr. @ Hwy 39	9/3/2013	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/12/2013	17.0

2835/36.8	St. Francis R. @Saco	9/16/2013	<15.0
2034/21.5	Bourbeuse R. above Union	9/17/2013	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	10/29/2013	46.0
847/23.2	Lamine R. nr. Pilot Grove	10/31/2013	29.0
1344/6.2	Cedar Cr. @ Hwy 39	11/5/2013	<15.0
2835/36.8	St. Francis R. @Saco	11/13/2013	<15.0
2034/21.5	Bourbeuse R. above Union	11/14/2013	<21.0
1344/6.2	Cedar Cr. @ Hwy 39	12/2/2013	<30.0
1344/6.2	Cedar Cr. @ Hwy 39	1/13/2014	66.0
2034/21.5	Bourbeuse R. above Union	1/13/2014	70.0
2835/36.8	St. Francis R. @Saco	1/13/2014	<30.0
847/23.2	Lamine R. nr. Pilot Grove	1/29/2014	<30.0
1344/6.2	Cedar Cr. @ Hwy 39	2/10/2014	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	3/18/2014	18.0
2835/36.8	St. Francis R. @Saco	3/24/2014	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/24/2014	<30.0
2034/21.5	Bourbeuse R. above Union	3/25/2014	<15.0
2034/21.5	Bourbeuse R. above Union	4/7/2014	64.0
1344/6.2	Cedar Cr. @ Hwy 39	4/8/2014	<15.0
847/23.2	Lamine R. nr. Pilot Grove	4/9/2014	39.0
2835/36.8	St. Francis R. @Saco	4/16/2014	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	5/6/2014	46.0
2034/21.5	Bourbeuse R. above Union	5/13/2014	15.0
2835/36.8	St. Francis R. @Saco	5/13/2014	<19.0
847/23.2	Lamine R. nr. Pilot Grove	5/28/2014	53.0
1344/6.2	Cedar Cr. @ Hwy 39	6/4/2014	29.0
2034/21.5	Bourbeuse R. above Union	6/16/2014	23.0
2835/36.8	St. Francis R. @Saco	6/17/2014	<15.0
847/23.2	Lamine R. nr. Pilot Grove	6/17/2014	54.0
1344/6.2	Cedar Cr. @ Hwy 39	7/8/2014	90.0
847/23.2	Lamine R. nr. Pilot Grove	7/9/2014	190.0
2034/21.5	Bourbeuse R. above Union	7/16/2014	26.0
1344/6.2	Cedar Cr. @ Hwy 39	8/6/2014	<15.0
2034/21.5	Bourbeuse R. above Union	8/11/2014	<30.0
847/23.2	Lamine R. nr. Pilot Grove	8/12/2014	356.0
2835/36.8	St. Francis R. @Saco	8/18/2014	<15.0
2034/21.5	Bourbeuse R. above Union	9/2/2014	<15.0
1344/6.2	Cedar Cr. @ Hwy 39	9/3/2014	29.0
847/23.2	Lamine R. nr. Pilot Grove	9/8/2014	63.0
2835/36.8	St. Francis R. @Saco	9/16/2014	<15.0
2034/21.5	Bourbeuse R. above Union	10/7/2014	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/8/2014	<28.0
2835/36.8	St. Francis R. @Saco	10/20/2014	<15.0
2034/21.5	Bourbeuse R. above Union	1/5/2015	24.0
847/23.2	Lamine R. nr. Pilot Grove	1/22/2015	<15.0
2835/36.8	St. Francis R. @Saco	1/27/2015	<15.0
2034/21.5	Bourbeuse R. above Union	3/9/2015	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/11/2015	<30.0
2835/36.8	St. Francis R. @Saco	3/17/2015	<15.0

2835/36.8	St. Francis R. @Saco	4/8/2015	<15.0
2034/21.5	Bourbeuse R. above Union	4/20/2015	<15.0
847/23.2	Lamine R. nr. Pilot Grove	4/21/2015	76.0
2034/21.5	Bourbeuse R. above Union	5/4/2015	<15.0
2835/36.8	St. Francis R. @Saco	5/26/2015	31.0
847/23.2	Lamine R. nr. Pilot Grove	5/26/2015	382.0
2835/36.8	St. Francis R. @Saco	6/17/2015	27.0
2034/21.5	Bourbeuse R. above Union	6/22/2015	68.0
847/23.2	Lamine R. nr. Pilot Grove	6/23/2015	41.0
2835/36.8	St. Francis R. @Saco	7/13/2015	<15.0
2034/21.5	Bourbeuse R. above Union	7/20/2015	<30.0
847/23.2	Lamine R. nr. Pilot Grove	7/21/2015	195.0
2835/36.8	St. Francis R. @Saco	8/4/2015	<15.0
2034/21.5	Bourbeuse R. above Union	8/17/2015	<15.0
847/23.2	Lamine R. nr. Pilot Grove	8/19/2015	29.0
2835/36.8	St. Francis R. @Saco	9/2/2015	<15.0
2034/21.5	Bourbeuse R. above Union	9/14/2015	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/16/2015	<15.0
2835/36.8	St. Francis R. @Saco	10/14/2015	<15.0
2034/21.5	Bourbeuse R. above Union	10/19/2015	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/21/2015	19.0
2034/21.5	Bourbeuse R. above Union	1/11/2016	<15.0
2835/36.8	St. Francis R. @Saco	1/20/2016	<15.0
847/23.2	Lamine R. nr. Pilot Grove	1/26/2016	<15.0
2835/36.8	St. Francis R. @Saco	3/2/2016	<15.0
2034/21.5	Bourbeuse R. above Union	3/8/2016	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/14/2016	18.0
2034/21.5	Bourbeuse R. above Union	4/4/2016	17.0
847/23.2	Lamine R. nr. Pilot Grove	4/5/2016	31.0
2835/36.8	St. Francis R. @Saco	4/12/2016	31.0
2835/36.8	St. Francis R. @Saco	5/3/2016	<15.0
2034/21.5	Bourbeuse R. above Union	5/10/2016	15.0
847/23.2	Lamine R. nr. Pilot Grove	5/25/2016	50.0
2034/21.5	Bourbeuse R. above Union	6/6/2016	60.0
847/23.2	Lamine R. nr. Pilot Grove	6/7/2016	51.0
2835/36.8	St. Francis R. @Saco	6/15/2016	<15.0
2835/36.8	St. Francis R. @Saco	7/5/2016	<15.0
847/23.2	Lamine R. nr. Pilot Grove	7/19/2016	27.0
2034/21.5	Bourbeuse R. above Union	7/26/2016	<15.0
2034/21.5	Bourbeuse R. above Union	8/1/2016	17.0
847/23.2	Lamine R. nr. Pilot Grove	8/3/2016	102.0
2835/36.8	St. Francis R. @Saco	8/9/2016	<15.0
2835/36.8	St. Francis R. @Saco	9/6/2016	<15.0
2034/21.5	Bourbeuse R. above Union	9/12/2016	53.0
847/23.2	Lamine R. nr. Pilot Grove	9/14/2016	71.0
2034/21.5	Bourbeuse R. above Union	10/3/2016	<15.0
2835/36.8	St. Francis R. @Saco	10/19/2016	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/19/2016	23.0
847/23.2	Lamine R. nr. Pilot Grove	1/11/2017	<15.0

2835/36.8	St. Francis R. @Saco	1/17/2017	44.0
2034/21.5	Bourbeuse R. above Union	1/18/2017	<15.0
2034/21.5	Bourbeuse R. above Union	3/7/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	3/20/2017	26.0
2835/36.8	St. Francis R. @Saco	3/22/2017	<15.0
2034/21.5	Bourbeuse R. above Union	4/3/2017	25.0
2835/36.8	St. Francis R. @Saco	4/3/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	4/5/2017	105.0
2034/21.5	Bourbeuse R. above Union	5/23/2017	41.0
2835/36.8	St. Francis R. @Saco	5/31/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	6/7/2017	39.0
2835/36.8	St. Francis R. @Saco	6/12/2017	<15.0
2034/21.5	Bourbeuse R. above Union	6/20/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	6/28/2017	43.0
2034/21.5	Bourbeuse R. above Union	7/17/2017	19.0
847/23.2	Lamine R. nr. Pilot Grove	7/26/2017	35.0
2835/36.8	St. Francis R. @Saco	7/31/2017	<15.0
2034/21.5	Bourbeuse R. above Union	8/1/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	8/8/2017	128.0
2835/36.8	St. Francis R. @Saco	8/23/2017	<15.0
2835/36.8	St. Francis R. @Saco	9/7/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	9/11/2017	17.0
2034/21.5	Bourbeuse R. above Union	9/12/2017	<15.0
2034/21.5	Bourbeuse R. above Union	10/10/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/16/2017	119.0
2835/36.8	St. Francis R. @Saco	10/30/2017	<15.0
847/23.2	Lamine R. nr. Pilot Grove	1/9/2018	<15.0
2034/21.5	Bourbeuse R. above Union	1/16/2018	28.0
2835/36.8	St. Francis R. @Saco	1/17/2018	<15.0
2835/36.8	St. Francis R. @Saco	3/6/2018	<15.0
2034/21.5	Bourbeuse R. above Union	3/27/2018	102.0
847/23.2	Lamine R. nr. Pilot Grove	3/28/2018	160.0
2835/36.8	St. Francis R. @Saco	4/16/2018	<15.0
2034/21.5	Bourbeuse R. above Union	4/17/2018	63.0
847/23.2	Lamine R. nr. Pilot Grove	4/26/2018	15.0
2835/36.8	St. Francis R. @Saco	5/1/2018	<15.0
847/23.2	Lamine R. nr. Pilot Grove	5/8/2018	17.0
2034/21.5	Bourbeuse R. above Union	5/23/2018	108.0
847/23.2	Lamine R. nr. Pilot Grove	6/6/2018	19.0
2034/21.5	Bourbeuse R. above Union	6/11/2018	22.0
2835/36.8	St. Francis R. @Saco	6/11/2018	<15.0
847/23.2	Lamine R. nr. Pilot Grove	7/9/2018	19.0
2034/21.5	Bourbeuse R. above Union	7/10/2018	<15.0
2835/36.8	St. Francis R. @Saco	7/23/2018	<15.0
2034/21.5	Bourbeuse R. above Union	8/6/2018	<15.0
2835/36.8	St. Francis R. @Saco	8/8/2018	<15.0
847/23.2	Lamine R. nr. Pilot Grove	8/8/2018	25.0
2835/36.8	St. Francis R. @Saco	9/5/2018	<15.0
2034/21.5	Bourbeuse R. above Union	9/10/2018	91.0

847/23.2	Lamine R. nr. Pilot Grove	9/19/2018	<15.0
2034/21.5	Bourbeuse R. above Union	10/3/2018	<15.0
847/23.2	Lamine R. nr. Pilot Grove	10/17/2018	<15.0